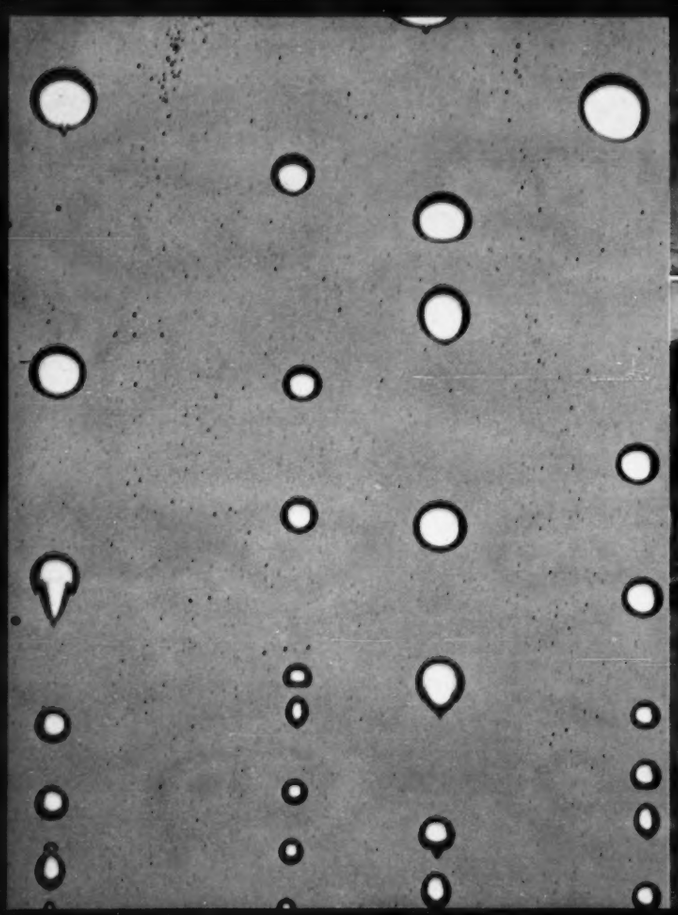
Design News

Metering valve measures flow by counting piston strokes. Page 10



A CAHNERS PUBLICATION

APRIL 10, 1961

What synthetic sealing materials should I use—and when

Environmental conditions generally dictate the type of synthetic rubber for a specific oil sealing application.

Where temperature, shaft speed, runout, eccentricity, and lubricant type are "normal", standard Buna N synthetic rubber compounds are satisfactory. If, however, the application is "dry running", a compound must be selected that will operate satisfactorily with a very small amount of lubricant. If the application involves excessive abrasion, highly "loaded" compound stocks should be provided. At temperatures over 250° F polyacrylics or silicone compounds are indicated; if high temperature is accompanied by a solvent base or additive lubricant, polyacrylics are definitely preferred.

Thus many variables govern successful oil sealing. The chart below gives more data; for complete information from the world's foremost oil seal laboratories, call your National Seal engineer. He's in the Yellow Pages, under Oil Seals or O-Rings.

SYNTHETIC RUBBER COMPOUNDS — **RECOMMENDED APPLICATIONS**

Comp. No.	Base Polymer	Min/Max Operating Temperature	Life Index	Price Index	Automatic Transmissions	Pinions	Axle Seals	Engine Seals	Misc. Applications
B-63	Buna N	—40°F/225°F	100	100				Excellent for small gas engines.	Excellent for small non-spring loaded seals.
B-86	Buna N	—30°F/225°F	100	100		Satisfactory for medium temperature applications.	Truck and automotive rear axles. General use.	Satisfactory as general purpose material where temperature permits.	General purpose Buna N applications.
B-94	Buna N	—60°F/250°F	100	100					Excellent against aromatics and some military aircraft oils, fuels.
B-95	Buna N	—30°F/225°F	100	100					Good dry running compounds for applications requiring high durometer stock.
C-6	Buna N	—30°F/225°F	100	100			Excellent for semi-rough axles. Has good wear qualities.		Good for pressure seals due to high durometer and clean trimming.
L-28	Acrylon BA-12	—30°F/300°F	400	125	Good for temperature range indicated.	Satisfactory in single lip construction.	Sealed bearing high temperature applications.	Satisfactory for automotive use. High temperatures.	Satisfactory for high temperature general applications. Can be used with EP or GL-4 oils.
L-34	Hycar PA-21	0°F/300°F	400	115	Good for temperature range indicated.	Dual lip limited contact for high temperatures.	Sealed bearing high temperature applications.	Satisfactory for automotive use. High temperatures.	Satisfactory for high temperature general single or dual lips. Ok with EP or GL-4 oils.
S-48	Silicone*	—80°F/400°F	1500	150	Excellent high and low temperature life.	Silicone Compounds Not Recommended With EP Lubricants at high temperatures.		Excellent for general engine use. Suggested for premium gasoline and Diesel engines.	Excellent wide range material. Avoid use in EP and GL-4 oils.
S-49	Silicone*	—80°F/300°F	600	130	Good at high and low temperatures.			Very good for general engine use; premium gasoline and Diesel engines.	Very good wide range material. Avoid use in EP and GL-4 oils.

*Silicones require special stabilization for satisfactory use in aromatic oils at high temperatures.

NATIONAL SEAL
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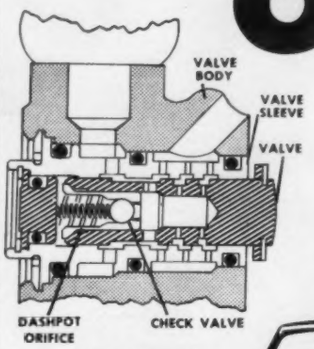
MINNESOTA MR RUBBER

INJECTION MOLDED O-RINGS



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- HIGH DENSITY
- WEAR RESISTANT
- CUSTOM COMPOUNDS

. . . give better service in any application

TOP SEALING EFFICIENCY is possible because Minnesota Rubber injection molding virtually eliminates flash and variations in part thickness.

HIGH DENSITY means longer seal life because it gives the O-rings outstanding resistance to chemicals and abrasion.

WEAR RESISTANT injection molded O-rings don't wear and extrude as easily as ordinary seals. They reduce replacement and loss of production due to downtime.

CUSTOM COMPOUNDS from Minnesota Rubber insure outstanding service because the O-ring will be made from the best material for your application.

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NFPA

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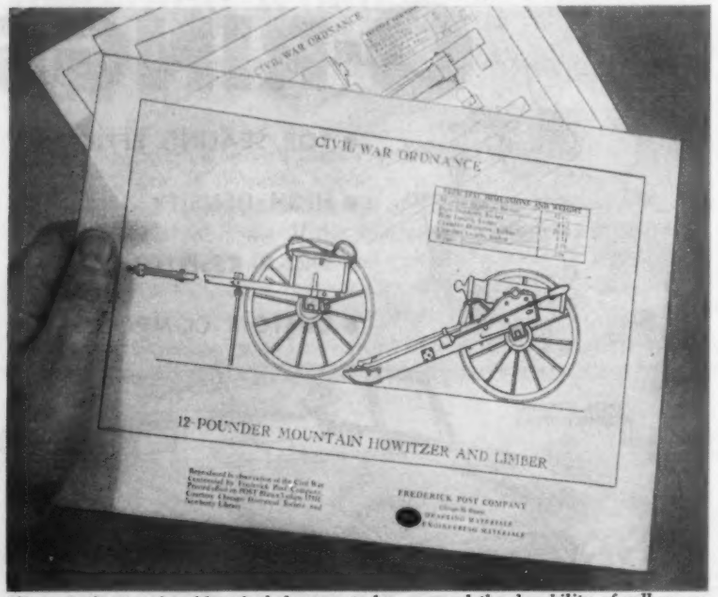

Through the decades, historical documents have proved the durability of vellum as indicated by the facsimiles of Civil War engineering drawings above, reproduced on POST Blutex Tracing Vellum.

We'll accept your test on which vellum is best

To judge a tracing medium thoroughly, you must combine functional tests and personal reactions to three characteristics.

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POST Blutex erases easily during initial drafting. More important, it erases readily even after repeated exposure to ultra-violet sources. Test this by taping a small sample to a sunlit window for several days.

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For your personal, impartial analysis, we'll be glad to mail, without obligation, a 17" x 22" sample of POST Blutex Vellum, 175H, *when requested on a business letterhead.*

Bonus offer
First, fill in and return the appraisal form furnished with the POST Blutex sample. In appreciation, a handsome portfolio of four Civil War Centennial ordnance prints, on POST Blutex Vellum, suitable for framing, will be sent to you. Write Frederick Post Company, 3640 North Avondale Avenue, Chicago 18, Illinois.

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SOUNDING BOARD

FOR OUR READERS

Spare Parts, Reliability—or Low Bid

I have just read your article in the Jan. 16, 1961, issue of DESIGN NEWS and would like to comment on a point which you failed to mention.

I agree fully with the philosophy that you point out for the procurement of replenishment spare parts for the military services. In paragraph six under "Industry Views", you would permit the company, which develops a product with its own capital, the right to keep its proprietary data. However, you do not explain how you would do this and still place all such data on drawings or other documents.

As we interpret military specifications, once proprietary data is divulged in documentation given to the military services, the data is no longer proprietary and a competitive company is given the right to manufacture the article at a quoted price which is not required to liquidate the cost of research and development. We hope that when the specification MIL-D-70327 is revised it will contain a note which the design manufacturer may place on his drawing to protect his legal rights to proprietary data.

A. C. VANINA
Documentation Analyst
General Electric Ordnance Dept.

. . . This is, indeed, a most serious problem and one which unquestionably stems from the government's immoral thievery of a company's designs. As we see it, the solution is simple and twofold:

1. Any drawings or specifications developed by a contractor should be supplied to the government only on a voluntary basis and upon full compensation that is agreeable to that contractor. Under no circumstances should they be stolen from him by force.
2. On those products or parts submitted by the government for competitive bids, adequate procurement specifications and, above all, adequate government inspection prior to acceptance should be maintained.

This latter item regarding government inspection is of the utmost importance and currently is not being done. The majority of government inspection now consists merely of "rubber stamping" paper work. This, of course, stems from the unquestionable and inevitable fact that the majority of government employees working for the faceless government, usually under Civil Service so they cannot be discharged for incompetence, will by their very nature seldom do an honest and competent day's work for their pay. They don't have to and history proves they never will.

As serious as this problem of dishonest and immoral confiscation by government of a firm's proprietary data and know-how is, we feel that a far more serious situation exists in the government's planned policy of refusal to settle contract termination claims. The backlog of these claims, some over five years old, now exceeds $6 billion. Enclosed for your information is a report covering the impact and scope of contract terminations, which has been prepared from recent industry surveys and Congressional committee hearings. This report has been included in its entirety in the printed Senate Armed Services Subcommittee Hearings on military procurement under the chairmanship of Senator Strom Thurmond.

Although the government's policy of refusing to promptly settle contract termination claims has a more devastating effect on small- and intermediate-sized businesses than on larger firms, the facts set forth in this report should nonetheless be of the utmost interest and concern to all companies doing business with the government. . . .

DAN FOLEY
President
Meteor Aircraft Products, Inc.

. . . As you know, the Institute has long been deeply interested in the problem of acquisition by government contract of manufacturers' proprietary technical data and in the current intragovernment dispute over the disposition of commercial rights to patents resulting from R & D contracts. A complimentary copy of a recent Institute pamphlet entitled "Reconsidering Government Patent Policies" is enclosed. Individual copies of the pamphlet are available at $2, and it may be that your readers may be interested in the publication. A list of further Institute publications appears as an appendix.

CHARLES I. DERR
Vice President
Machinery and Allied Products Institute

As an industry member of the Military-Industry Ad Hoc Committee which developed MIL-D-70327, I want to congratulate you on your Jan. 16 candid appraisal of existing conflicts concerning the procurement of reliable spare parts and the related engineering documentation problem.

I would like to reprint this article for distribution within the General Electric Co. and to my military associates. May I have your permission to do so?

R. F. FRANCIOSE
Eng. Adm. Consulting Service
General Electric Co.

• **Permission granted. E.R.C.**

The Best Material

Is structural steel necessarily the best material to use in every structure? Is aluminum necessarily the best for all the traditional applications of this metal? Is chrome plating necessarily the best way to protect metal surfaces such as car bumpers?

These, and many other similar questions, face designers every day. Unfortunately, many times they remain unanswered.

There is such a thing as inertia in the field of design as in many other fields. We are all prone to do things a certain way simply because we have been doing them that way for some time. In the field of materials all designers are prone to use the traditional materials, many times without any further justification.

There is really only one criterion to use in selecting a material for any given design. The material must do the best job possible within the framework of the given designer parameters. If it fails, even in one point, to meet these demands it is not the best possible material. The spotlight of stiff competition has been placed on the steel industry. Steel men are wondering how they can expand their markets for steel in the face of inroads made by aluminum, prestressed concrete and even, in some cases, by nonmetals. In a way this is a very healthy sign since it shows a certain amount of forward thinking on the part of designers. At least in some areas, people are thinking about and investigating other means of doing things. It will be up to the steel industry to find new uses for their product—in the same way that the aluminum industry has found new uses for theirs.

There is a certain amount of danger in using a new material for a traditional application. The designer has to investigate every possible facet before deciding on the new material. If he fails to do so, he can easily end up with a product that costs too much, or that will fail in 101 ways. This is probably the toughest part of any design. It certainly takes more thinking to investigate materials from every possible side than it does to choose the traditional material.

The payoff, however, can be very significant. Some of the most successful products that have appeared on the market in recent years have been successful primarily because of the materials used. A case in point is the drip pan described on page 116 of this issue. Here the designers found that the original materials were not necessarily the best materials. It is a case of overcoming design inertia.

J. P. Dubois

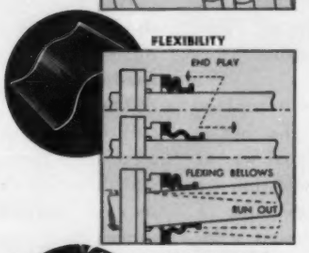
Managing Editor

JOHN CRANE

Shaft Seal Design With A Purpose!

POSITIVE DRIVE

This gives long seal life. Drive is transmitted through the driving band and washer driving notch which absorb all breakout and running torque. Damaging stresses on the bellows or flexible sealing member are eliminated. Slippage is also eliminated, thus protecting shaft or sleeve against galling.



FLEXIBILITY

Axial and radial misalignment problems are eliminated. Self-adjusting bellows or sealing head automatically compensates for shaft end play or run out. Minimum spring pressure is required for axial shaft movement and uniform spring pressure is maintained during radial shaft movement.

PRECISION MANUFACTURE

Leakproof performance is assured. Washer and seat surfaces are precision lapped to a perfect mate under a patented "John Crane" process.

A SEAL FOR EVERY SERVICE

All "John Crane" Seals are constructed to the particular service requirements . . . from hot or cold water to the most destructive acids, corrosives and gases . . . temperatures up to 1000°F. . . . pressures to 1200 psi. They can be furnished in types and sizes to meet practically any mechanical or dimensional condition.

Request Bulletin S-204-2. Containing full information on "John Crane" engineered shaft seals.

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CRANE PACKING COMPANY

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Small Gear Box, Liquid-Cooled Motor Reduce Spindle Head Size

Lars G. Soderholm, Midwest Editor

NILES, ILL.—An unusually compact spindle head is the result of a tight packaging of the gear train and the use of a liquid-cooled drive-motor. The drive train between the motor and the spindle provides multiple speeds.

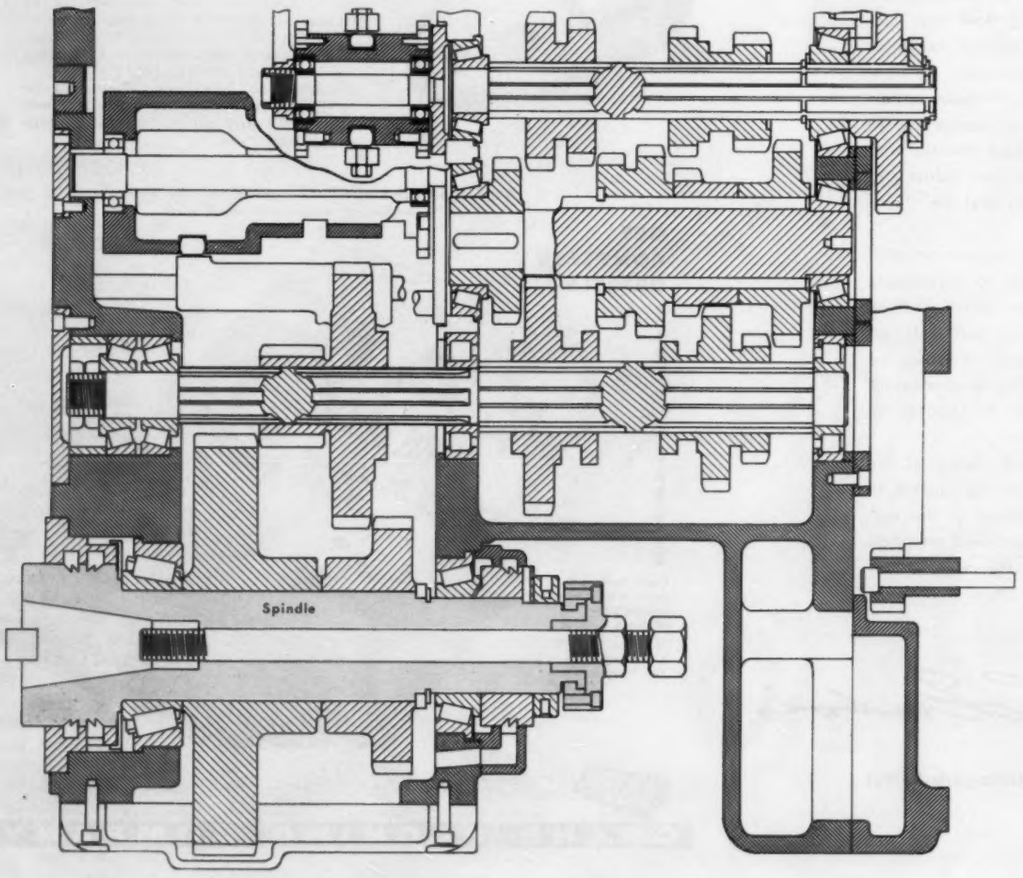
The new design of spindle head is used to replace older heads on milling machines when higher horsepower requirements are needed. Design goal was to provide higher power and a better selection of speeds, all in a smaller package. As an example of the attainment of this goal in the final design, a 50-hp head measures only 20 inches square and 54 inches high.

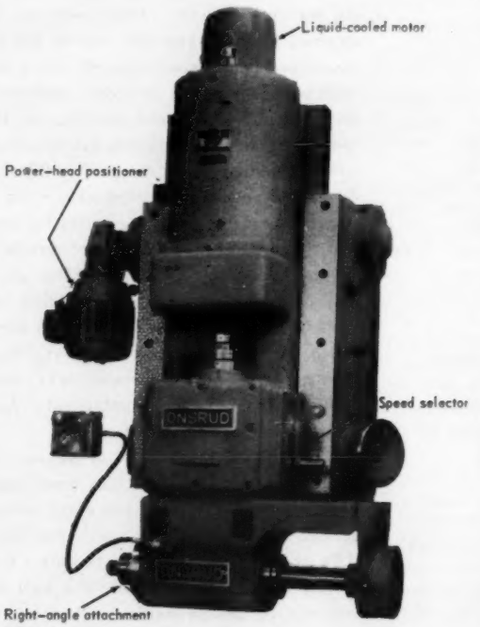
Water-cooled drive-motors are provided to avoid the size, weight and price of air-cooled electric motors of the same horsepower. Coolant for the 50-hp head is supplied at a rate of 12½ gpm.

The drive train between motor and spindle consists only of spur gears. No intermediate devices are used. The spur gears eliminate any deflection or end thrust on the bearings. The drive gears are all set close together and are shifted into various speed ranges by a dial lever control. Up to 24 spindle speed changes are possible, ranging from 12½ to 1250 rpm or 18 to 1800 rpm.

The gear housing acts as a sump for the gear lubricant. An integral pump circulates the lubricating oil in a totally enclosed system. The spindle head can be operated in any position. It is provided with a No. 50 NMTBA taper in the nose of the spindle. The 50-hp head without slide weighs approximately 1975 lb. A right-angle attachment, weighing 480 lb, can be furnished as auxiliary equipment.

The MH-50 spindle head is manufactured by the Onsrud Machine Works, Inc.

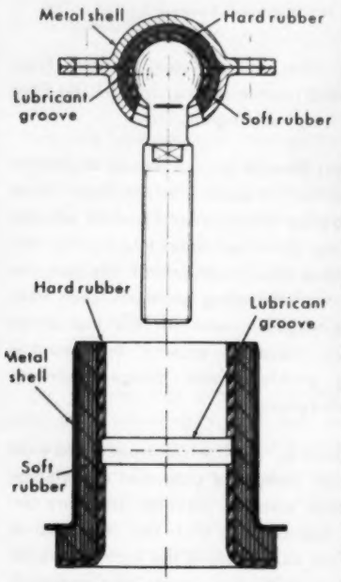




COMPACT GEAR TRAIN uses five shifting forks to select gear combinations for speed control. Single speed-selection dial provides progressive changes through use of segmented gear and cam. Bull gear is equivalent in mass to largest cutter that can be used with head. Large-diameter spindle is constructed of forged alloy steel and supported by large bearings to prevent deflection under any combination of axial and radial loads imposed by cutter.

Elastic Base Improves Bushing Performance

Celestino O. Lubatti,
Italian Editor

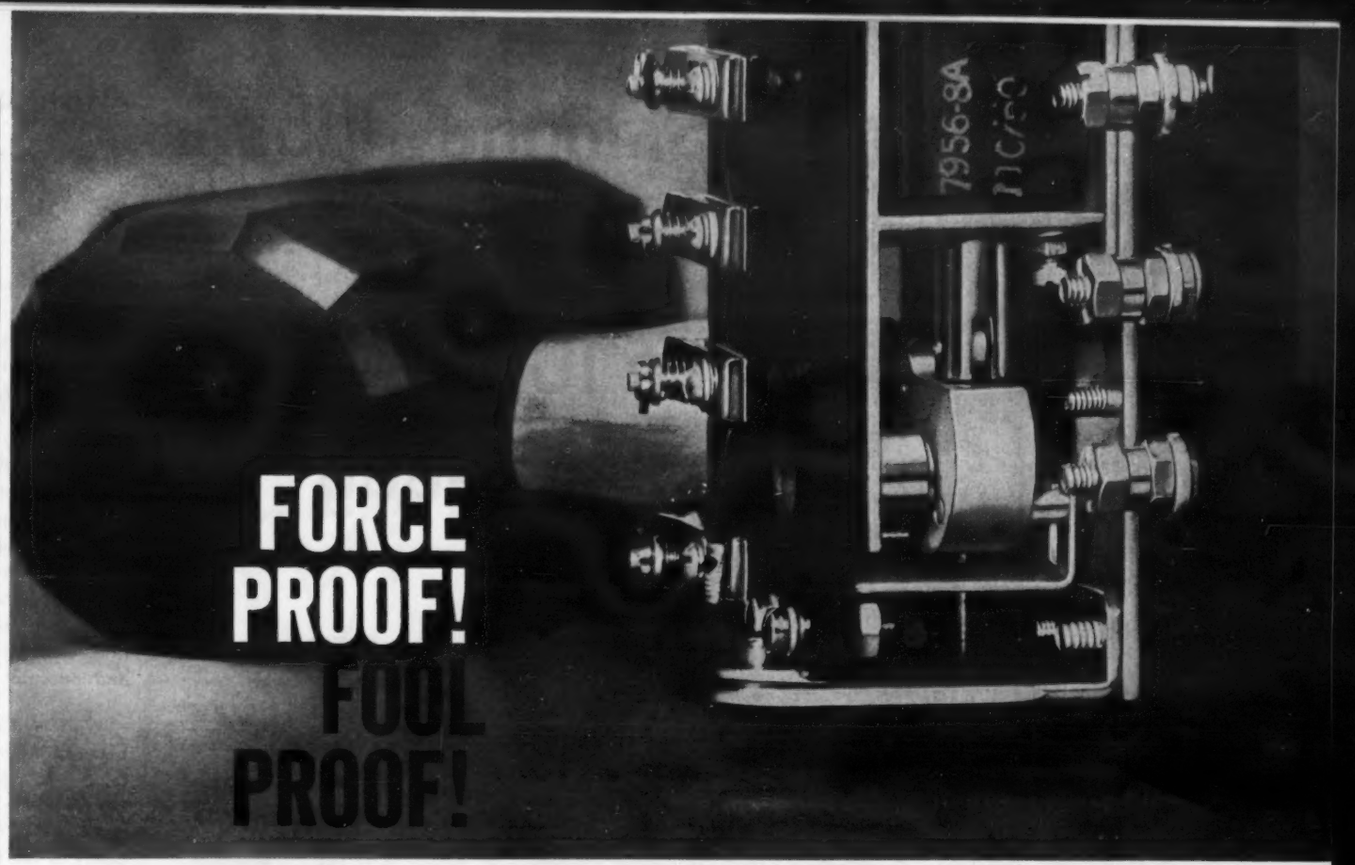


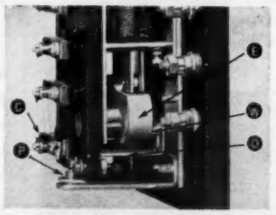
MILAN, ITALY—Two superimposed rubber sleeves of different hardness form the cushioning and the anti-friction layers, respectively, of a flexible bushing. Elimination of the internal metal sleeve increases surface flexibility and reduces production costs created by narrow tolerance limits. Torsional stresses and wear encountered in conventional pin (or ball) joints are virtually eliminated.

Rubber sleeves are attached and packed into the outer metal shell during vulcanization. A groove in the internal sleeve holds a lifetime grease supply.

Hardness of the internal layer is about 85 Shore, whereas that of the intermediate layer is only 60-65 Shore. The difference in hardness allows internal sleeve to behave as a semirigid bushing.

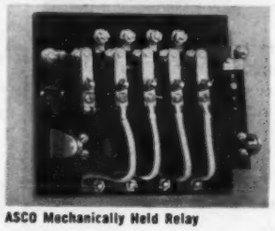
The flexible bushing, a development by Pirelli-S.A.G.A. SpA, is used in the suspension and steering mechanisms of Italian cars.





The Unique ASCO Mechanically Held Movement When the solenoid is energized, eccentric cam (F) is rotated. Weight drive pin (N) causes movement of operating lever (B). Lever (B) (connected to the contact finger block) rotates on pivot pin (P) and contacts such as (T) are opened or closed.

With the solenoid de-energized, the entire mechanism is firmly locked in place by the angular position of the linkages—no springs, latches, or semipermanent magnets required!



ASCO Mechanically Held Relay

even **brute force** will not release the ingenious locking mechanism of **ASCO MECHANICALLY HELD RELAYS**

We don't recommend using it, of course; we just want to emphasize that, short of deliberate destruction of the linkages, only one force can release this powerful locking mechanism and change relay contact position. That force is normal energization of the solenoid coil. Nothing else will alter the angular relation of the linkages, which maintains positive contact pressure despite vibration, gravity, or control circuit failure.

The unique mechanical movement is the heart of any ASCO Mechanically Held Switch or Relay. At the instant of operation, a momentary surge of electrical power retracts the solenoid core to rotate a cam. Momentum carries the cam beyond dead center, and spring-loading completes the core-return stroke to relock the relay in the new position. Linkage action is the same whether contacts are opening or closing; thus the relay is power-driven in both directions.

Design simplicity, typified by the single-solenoid coil mechanism, and rugged, compact construction are characteristic of ASCO Mechanically Held Relays. Complex and less dependable elements such as hooks, latches, semipermanent magnets, or gravity-operated devices are not used. These ASCO relays operate in any position; without AC hum or chatter, and without derating for enclosure.

The extensive ASCO line includes a Mechanically Held Relay to meet your requirements precisely; single pole or in combinations of 24 poles; single or double throw; 10 and 25 amperes; to 250 volts DC, 600 volts AC.

Send for Relay Catalog 57-S4, which shows you how to select the optimum relay for your specific needs.

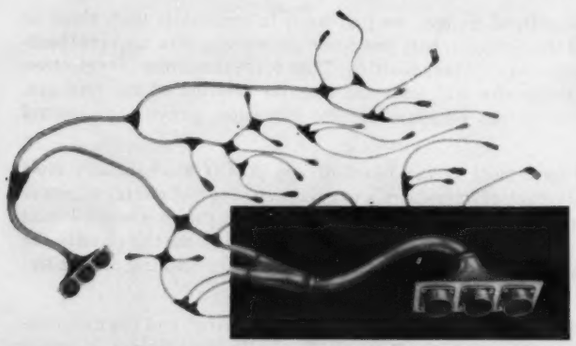
ASCO Electromagnetic Control ASCO

DEPENDABLE CONTROL BY Automatic Switch Co. 50-D HANOVER RD., FLORHAM PARK, N. J. • FRONTIER 7-4000 • AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

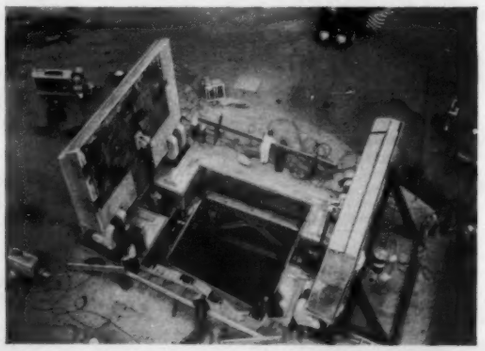
Circle 245 on Reader-Service Card

General Electric Silicone Rubber helps get Titan ICBM combat-ready

Missile and ground-support applications are "naturals" for the unique qualities of silicone rubber—heat resistance above 600°F, low-temperature flexibility to −150°F, good thermal conductivity, unexcelled ozone resistance and virtually unlimited life under normal conditions. Because it retains its excellent electrical properties over a wide temperature range, G-E silicone rubber is also used for missile wire and cable insulation. Even when continuously exposed to direct flame, it forms a non-conducting ash which gives off no toxic fumes.



Missile wiring harness—General Electric silicone rubber was chosen by Aerojet-General Corp. for the Titan's propulsion system wiring harness. Breakouts and junctions are molded from G-E RTV (room temperature vulcanizing) silicone rubber; wiring is silicone insulated; jacketing is high-strength G-E silicone rubber. Inset shows silicone rubber inserts in connectors. RTV is used in other missiles as a shock-absorbing encapsulant and potting material for electronic assemblies.



200 tons of steel and concrete—Titan missile silo doors by American Machine & Foundry Co. use seals of G-E silicone rubber. AMF also used G-E silicone rubber door seals on the Titan's ground support entry portals and radar silos. Silicone rubber can withstand the heat of rocket blast-off or possible atomic attack while remaining stable in storage for long periods.

Write for more information on G-E silicone rubber, briefly describing your application. Section D434, Silicone Products Department, Waterford, New York.

GENERAL ELECTRIC

Circle 5 on Reader-Service Card for more information

SEEN AND HEARD

PLASTICS TROUBLE-SHOOTER

Victor W. Wigotsky, Eastern Editor

I had a talk the other day with Jack Cheney, Plastics Consultant and trouble-shooter for E. I. du Pont de Nemours & Co., Wilmington, Del.

Mr. Cheney has been in various phases of plastics work with du Pont for 19 years. This just about spans the period following World War II, when plastics started to jump out of the test tubes into product designs and countless other applications. He first did plastic research on fabricating problems, then went into process development and for the last seven years has been traveling around the country, trouble-shooting problems with design engineers and industrial designers.

We talked about a "gap" which appears to exist between the large amount of data and experience, relative to plastics, and the attitudes of many designers in their approach to their use. We tried to determine to what extent this is the fault of the industry or the fault of the individuals who approach plastics with inhibitions and uncertainty.

Jack Cheney feels that many engineers and designers could derive a lot of satisfaction from a more positive approach to the field. Much of the required information is available and many seemingly difficult questions can be answered. He contends that it requires application, combined with an open-minded attitude.

Mr. Cheney puts it this way, "With reference to taking a 'new' approach to plastics, there are men who may have had a bad experience and have made up their minds that plastics will not work. Then there are those who are very conservative in design and are not interested in making changes. Others expect a universal material for about five cents a pound that will solve all their problems. Many, on the other hand, are motivated to use plastics, but are confused by the number and variety available."

Mr. Cheney feels that the basic problem in these groups is really insufficient knowledge of the plastics available, the successful applications of these materials and the opportunities that they offer. Plastics are variously described as either inexpensive substitutes or much too expensive on a per-pound basis, sometimes by the same person. Neither is completely true, of course. But the broad range of

possibility should certainly whet the designer's appetite.

I asked how we can intelligently juggle all the trade names and polysyllabic words, like "acrylonitrile" and "polytetrafluoroethylene". This a problem, for the industry as well as the designer. However, it always comes back to the necessary effort by designers to understand what is available. This will indicate that the many trademarks really facilitate selection of one composition of a general type, best suited to the application.

Mr. Cheney has some recommendations which may seem elementary, but are nevertheless important if the "gap" between available knowledge and its practical use is to be closed. First, the designer should really feel comfortable with a few of the typical plastics, the generic types. A dozen will cover a large percentage of the applications in any industry. While doing this, he should also learn a few of the successful applications for each material, even those in fields not related to his own. This can be an excellent source of creative ideas for solving a specific problem. Another essential thing is to recognize a lack of design experience with plastics, when this is the case, and to lean on the material suppliers for information and suggestions, based on their previous experience. Before final design, several plastics processors should be contacted for their recommendations. It can save considerable expense.

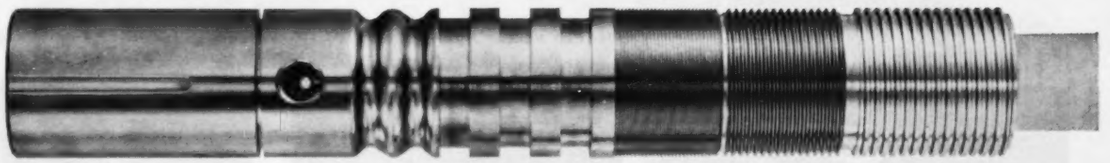
This can do much to overcome a widely prevalent feeling, mainly because of lack of experience with the materials, that sufficient data are not available for really intelligent design with plastics. This is no longer true. Suppliers have comprehensive handbooks that remove guesswork. These present a wide variety of data needed in any design job.

True, it sometimes seems that the fast pace of plastics development is a little like being spun around inside a kaleidoscope, filled with many color-impregnated materials. Polyethylene? Chlorinated polyether, acetal resin, cellulose acetate butyrate, or what?

The industry is now better coordinating much of the available information and making it readily usable. And men like Mr. Cheney are around, so we needn't avoid the forest because of the trees.

THEY LAUGHED
WHEN WE SAT DOWN
TO PLATE...

they didn't know about **KANIGEN®**



This shaft was turned. It was key-slotted, drilled, tapped and shouldered. It was threaded, milled, grooved and chamfered. It was step-bored, with three inside diameters. Who could plate a piece like this all over—inside and out—and expect a uniform coating?

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The KANIGEN® process for chemical nickel alloy plating produces a uniform thickness of coating, regardless of the contours of a part. This uniformity permits full machining operations prior to coating, with no subsequent cleanup.

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DESIGN NEWS SPECIAL REPORT

Precision-Rolled Profiles

E. J. Stefanides, Central States Editor

Precision-rolled profiles are a rather special type of custom cross-section material intended to reduce difficult or complex machining. They are manufactured by a cold-rolling method originally developed for production of buckets and nozzles of steam turbines.

Although early developments in this field were aimed at the production of airfoil shapes, there has been increasingly more activity in the application of non-airfoil sections. These sections, though expensive from a material standpoint, offer cost-reduction advantages through the elimination of much, or all, of the machining of the particular precision component.

Sizes and Shapes

In size, sections range from 0.010 lb per ft to 9.5 lb per ft and up to 7 by 1 inch in cross-section. There are no standard or stock shapes.

Cross-sections are designed to generate as closely as possible the desired profile of the finished product, within the limits of rollability. In special cases, a profile may be selected to eliminate machining of a particularly critical or difficult contour.

Materials, Tolerances and Finishes

Shapes are currently being manufactured to order in low-carbon, alloy and stainless steels and in titanium and high-temperature metal alloys. Specifications of exact limits on finishes and tolerances vary because of the interrelated and complex character of factors involved in production of specific shapes. Finishes down to 10 rms and tolerances of 0.001 and 0.002 inch are not uncommon, however.

Economical Factors

There are no general formulas for evaluating the economics of using a precision-profiled section in preference to a more conventional method of fabrication. Each application must be evaluated in relation to costs of other materials and machining which can be eliminated.

The amortization of special tooling costs involved in the manufacture of the precision-rolled profile material tends to favor quantity production. Moderate minimum order requirements can be satisfied, however, where special tooling costs can be held within reasonable limits.

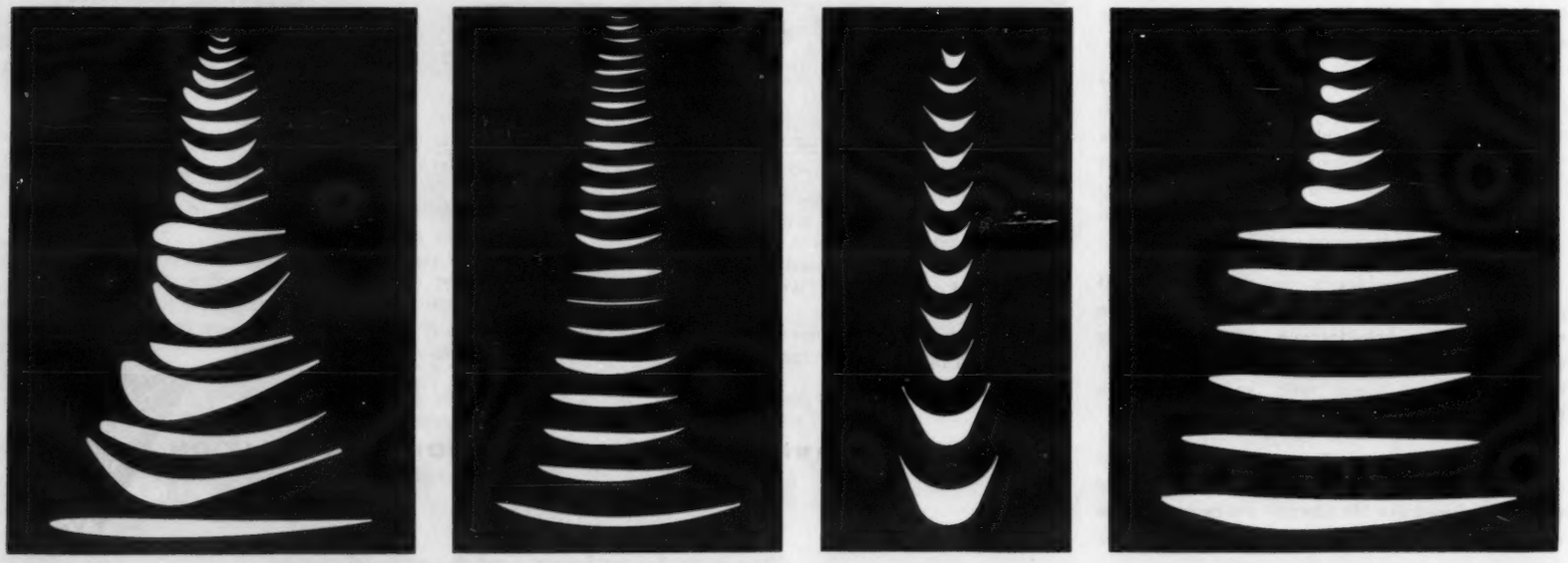
Typical Applications

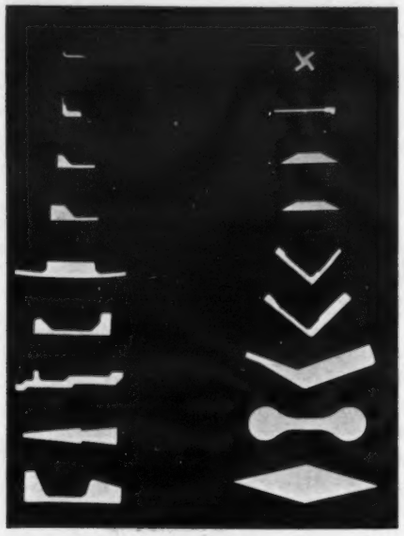
Typical applications are those in which the component part would otherwise be fabricated by machining, forging or precision-casting techniques. The material cannot be considered as an economical alternative to hot-rolled, cold-drawn or common extruded materials.

One application involved the fabrication of large-diameter, thin-section rings by forming and welding. When these sections were formerly welded into a ring and then machined, they tended to twist and lose their circular shape.

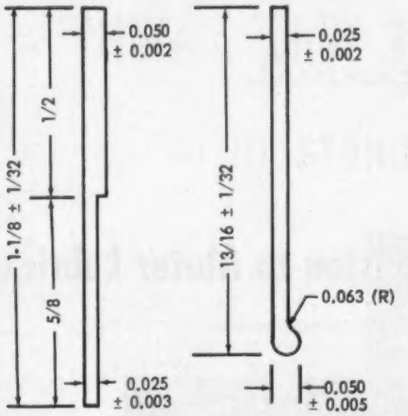
Information presented in this article was provided by the Universal Cyclops Steel Corp., Bridgeville, Pa.

SHAPES used in steam turbines, jet engines and high-quality torque converters.



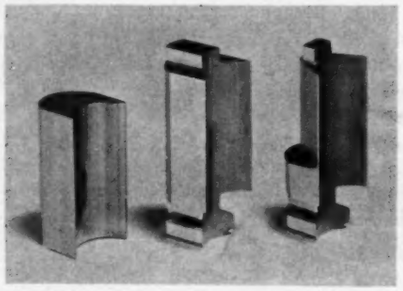


TYPICAL NON-AIRFOIL SHAPES

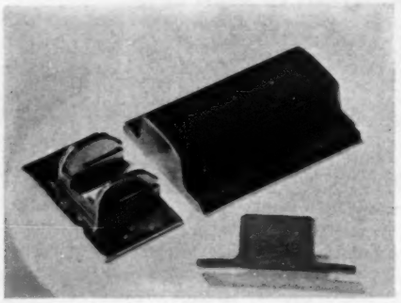


CENTER CHEVRONS SHOULDER CHEVRONS

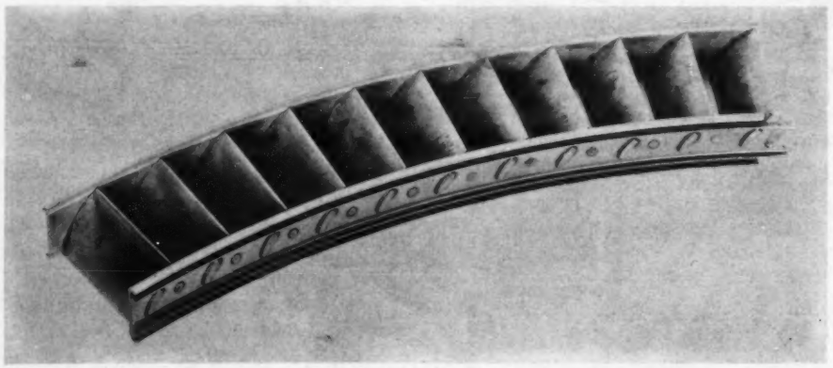
TIRE MOLD SIPES are extremely thin shapes designed to be fit into accurately aligned tire molds. Rolled material was selected after difficulties were encountered in attempting to machine these pieces.



ROOTED STEAM TURBINE BUCKET is machined from very precise "U"-shape rolled in type 403 turbine blade material (12 percent chrome). Two sides and concave face are rolled in precision relation to each other. These three surfaces are not subsequently machined or corrected.



JET-ENGINE COMPONENT is machined from section rolled in type 321 stainless.



PORTION of jet-engine compressor stage shows three special profiles rolled in 403 turbine material. Shroud consists of two profiles formed in ring shape, spot-welded together and punched for blades. Only machining required on blade is cutting to length and notching.

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for
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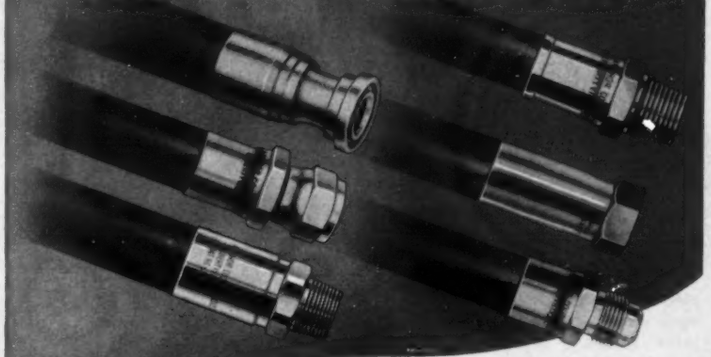

Anchor Pressed-On Hydraulic Hose Assemblies are demonstrating their *complete reliability* — as they have for over 20 years — on all fluid power equipment . . . contributing substantial savings in original and replacement costs . . . reduced maintenance . . . longer life . . . and uninterrupted service.

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There are Anchor Pressed-On Hydraulic Hose Assemblies to meet the exacting needs of all hydraulic transmission lines . . . for high, medium and low pressure service . . . with maximum working pressures ranging from 12,500 psi for 3/16" I.D. 6-Ply Super Spiral Hose to 100 psi for 2" I.D. Spiral Wire Suction Hose.

Write today for Anchor Catalog No. 102 showing the complete line of Anchor Pressed-On Hydraulic Hose Assemblies, together with detailed specifications, etc.

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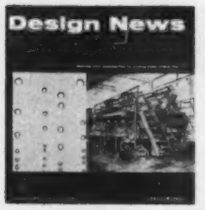
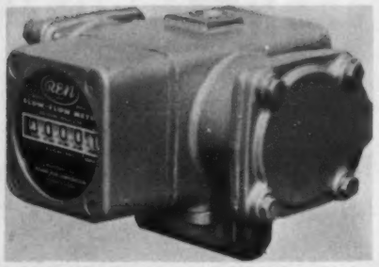
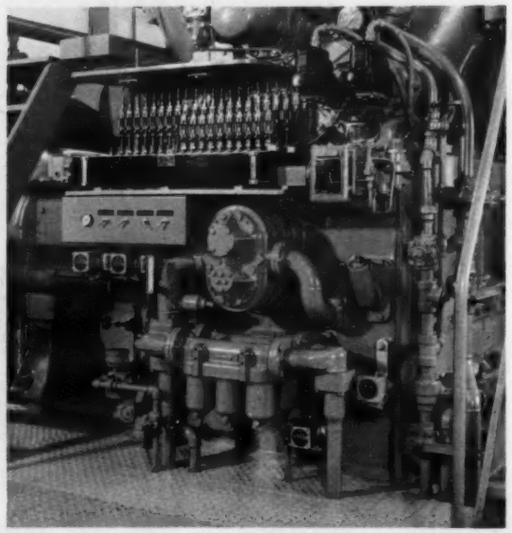


Cycling Valve Reciprocates Piston to Meter Lubricating Oil

Edward W. Schrader, Western Editor



SLOW FLOW METER is normally set up to bypass without recording bypass flow whenever demand exceeds capacity of meter. This is particularly useful in lubrication service, which places higher priority on continued supply of lubricant than upon metering. Pressure regulator can be calibrated to point below minimum bypass pressure. This places priority on metering rather than insured delivery. Reference pressure at regulator is normally atmospheric; however, downstream pressure may be used, in which case regulator determines pressure drop only through metering elements.

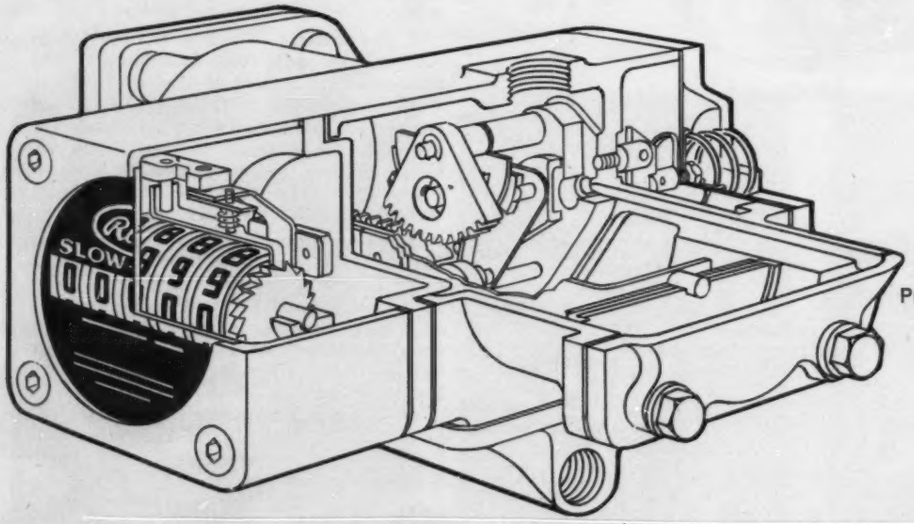


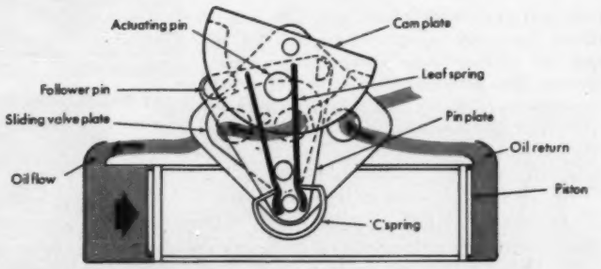
A positive-displacement flow meter records flow by counting the stroke of a piston assembly. A cycling valve alternately applies pressure to either end of the piston assembly, causing it to oscillate.

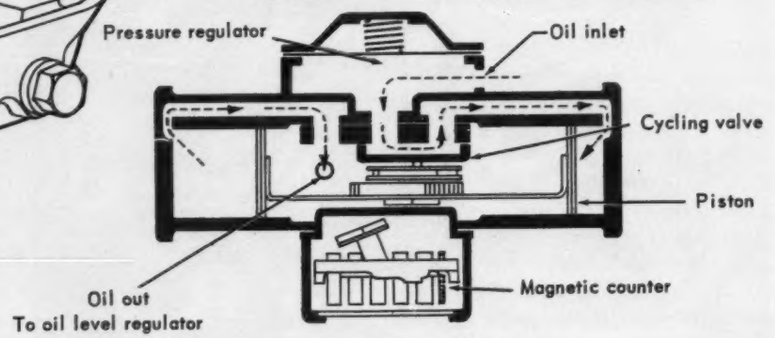
The piston rod carries a driving magnetic element in the center chamber of the meter. The driven element is in magnetic opposition to the driving element, and it indexes the counter assembly through a ratchet. Resulting action of the counter occurs at the same point in each cycle of piston operation.

A built-in pressure regulator reduces supply pressures from a maximum of 100 psig to a net delivered pressure of about 2 psig at the meter exit. Valve

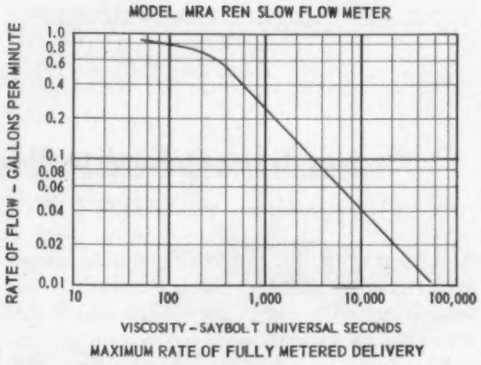
CAM PLATE has projections on back side. Sector is rotated by rack, causing actuating pin to bear against leaf spring. Cam plate rotates until projection clears follower pin, freeing pin plate to be rotated by other half of spring. Rotational movement of pin plate slides valve plate over to actuate one piston.







SCHEMATIC FLOW DIAGRAM



MAXIMUM DELIVERY is limited by viscosity of fluid being metered. It varies from 0.8 gpm for low-viscosity fluids to 0.001 gpm for high-viscosity fluids. Meter has recorded small flows at rate of one pint in 24 hours, with permissible leakage of 1 percent. This rate is obtained by using "Teflon" piston cups fitted to anodized and honed aluminum cylinder bores.

action is obtained by bringing incoming pressure to the valve seat and using pressure drop past the valve to reduce valve seating force in proportion to the drop. The valve block acts the bypass valve. Calibrated springs apply normal valve seating force. This design approach avoids valve loading with increased pressure drop.

The meter is calibrated by varying a small lost-motion or over-travel of the piston assembly. A rack carried on the piston rod drives a mating gear sector, which in turn pivots a cam plate. Lost motion between cam plate and sector may be adjusted by turning a small set-screw on the sector. The screw makes contact with an actuating pin on the cam plate passing into a hole in the sector.

Initial calibration of valve release is done mechanically, using a dial indicator on the piston assembly. Piston travel between opposite points on valve release is adjusted to the nearest 0.001 inch. This corresponds to an order of accuracy of 0.1 percent. Final adjustment is checked by actual measurement of delivery through the meter.

To record U. S. gallons, the meter requires 20 piston cycles per gallon, or 20 counter registering impulses to the 10th's wheel of the counter. The figures on the 10th's wheel read either directly on or directly between tenths of a gallon. This makes the meter readable to the last registered 20th of a gallon.

The Ren Model MRA Slow Flow Meter is designed to supply the Ren oil-level regulator for engine lubricating oil make-up service. It is a design development of Power Plus Corp., Los Angeles, Calif.

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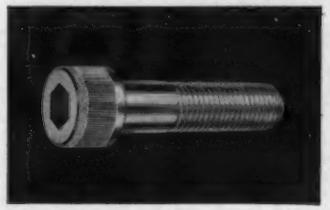
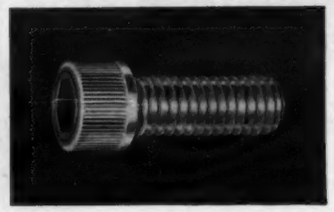
Here's what **SPS**—and only **SPS**—now offers you in **standard** socket head cap screws



UNBRAKO pHd Hi-Life, today's only all-new socket screw. Increased bearing area, radiused thread root give up to 2⅓ times as much holding power, twice the fatigue strength of ordinary screws.

K 16 socket heads give you a bonus of 300% more fatigue life than regular socket screws; replace costly specials, provide design insurance in high fatigue applications.

Stainless UNBRAKOS meet your needs for corrosion-resistant fastening through a temperature range from −300° to 800°F. Other design considerations: low magnetic permeability; good appearance.



UNBRAKO KS 812 stainless socket screws offer 125,000 psi tensile—*certified;* help you increase strength of stainless assemblies without paying the price of specials. Identified by groove around socket.

Lately you have been reading about new developments in the design and performance of UNBRAKO socket head cap screws. For your reference, here is the complete story in one package:

UNBRAKO pHd* with Hi-Life Thread
The advanced tension fastener for the '60s. New pHd head with increased bearing area gives you up to 2⅓ times as much holding power, safeguards preload, defies loosening under vibration. Radiused root of new SPS Hi-Life thread form drastically reduces stress concentrations at point where 85% of screw failures occur. Result: Twice the fatigue life. Forged heads, rolled threads preserve grain flow, add further strength and fatigue resistance. Available with Nylok† self-locking feature if desired. Sizes #0 to 1½ in. in alloy steel . . . full range of plating and other finishes. Tensile strength: 160-200,000 psi.

Stainless UNBRAKO Socket Screws
Available in a variety of corrosion-resistant alloys . . . and with Nylok. Standard processing includes passivation surface treatment, which forms a protective film and removes contaminants. Silver plating and/or molybdenum disulfide can be added as a lubricant to prevent galling and reduce the thread friction sometimes encountered at elevated temperatures. Sizes #0 to ⅜ in. with forged pHd head and fully formed Hi-Life thread.

NEW HIGH-PERFORMANCE UNBRAKO K SERIES

UNBRAKO K 16—Endurance fasteners replace specials in high fatigue service. They give you *twice* the fatigue life of regular UNBRAKOS; *four* times that of ordinary socket heads—in a *standard* fastener, reasonably priced. Threads rolled, fillet under head cold worked—both after heat treat. Shank precision ground to insure no decarburization. Sizes #8 to ½ in. in 8740 A.Q. steel. pHd head, Hi-Life thread.

UNBRAKO KS 812—A stainless socket head cap offering a guaranteed tensile strength of 125,000 psi *minimum.* Yet this precision forged, burr-free fastener is a standard, available in quantity off the shelf. Made of high-grade austenitic stainless, hardened through cold working. Has pHd head for greater holding power; SPS Hi-Life thread for increased fatigue resistance. Magnetic permeability under 1.2. Serviceable from −300° to 800°F. Sizes #8 through ⅜ in.

Standard UNBRAKO socket head cap screws are available from stock through your industrial distributor. See him for more information or write Standard Pressed Steel Co. INDUSTRIAL FASTENER Division, SPS, JENKINTOWN 6, PENNSYLVANIA.

*proper Head design (1960 Series)
†T.M. Reg. U.S. Pat. Off., The Nylok Corporation

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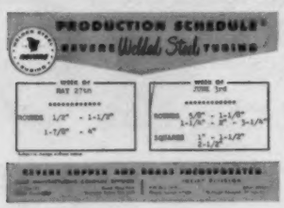

Shown at left is a sample of the card mailed every two weeks, in advance, showing Revere's Production Schedule. Our customers have found it to be extremely helpful. Shall we place your name on the list? No obligation, of course, and you need not be a Revere customer.

Send today for these two informative booklets: 1 — Revere Welded Steel Tubing Catalog. 2 — Commercial Tolerances for Welded Steel Tubing.

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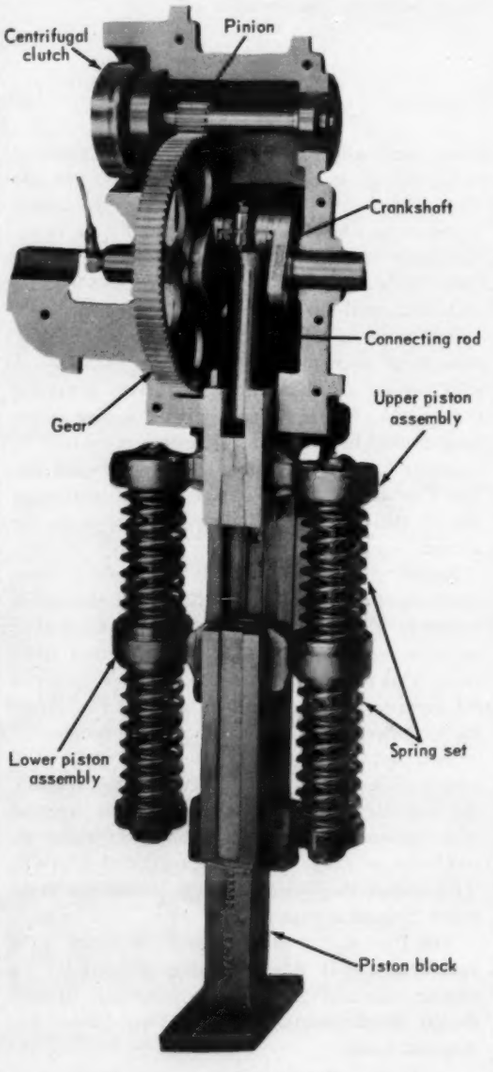
Springs Transmit Force to Shoe

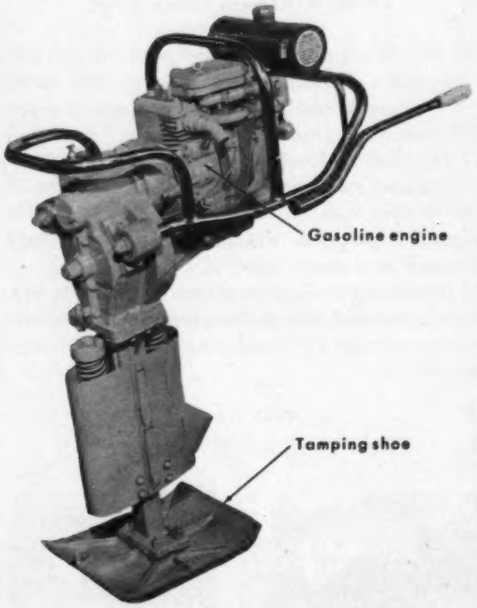
Lars G. Soderholm, Midwest Editor

A self-contained, self-propelled portable tamper uses, a gasoline engine driving a crankshaft and connecting rod to load a set of triple-nested steel springs. The springs store and release this energy, causing the lower piston block which holds the tamping shoe to supply a series of ram-action blows on the material below.

A 3-hp, 3600-rpm, 4-cycle, air-cooled engine acts as the power source and drives the pinion



of Portable Impact Compactor



shaft through a centrifugal clutch. A single speed reduction is obtained through a spur gear and pinion set and drives the crankshaft at about 450 rpm. The connecting rod imparts a reciprocating motion to the upper piston assembly. The lower piston assembly is sandwiched between spring sets on two guide rods that are fastened to the upper piston assembly. Motion is transmitted from the upper piston assembly to the lower piston assembly through the spring sets.

In operation, the centrifugal clutch permits the gasoline engine to start and idle without actuating the compacting mechanism. As the engine is brought up to speed, the eccentric motion loads the springs which release their energy to the tamping shoe as a rapid heavy blow.

The spring set separates the tamper shoe from the engine and drive train during operation to isolate the equipment from ground impacts. When in operation, the unit suspends itself about 2½ inches off the ground as it strikes the ground about 450 blows a minute.

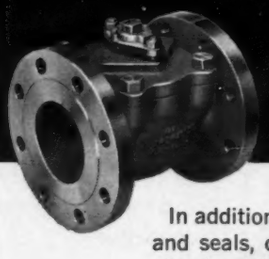
This unit weighs 137 lb and applies a blow of 440 ft-lb. Four different shoe sizes are available. Fuel capacity is 2 qt.

The "Rapak" portable impact compactor is made by Racine Hydraulics & Machinery Inc., Racine, Wis.

How to buy a ball valve!

Check these features!

	FLO • BALL	VALVE A	VALVE B	VALVE C	VALVE D	VALVE E
1. TOP ENTRY	√			√		
2. IN-LINE MAINTENANCE	√			√	√	
3. TOP AND BOTTOM GUIDED BALL	√					
4. DOUBLE SEATS	√	√	√	√	√	√
5. FLANGES INTEGRAL WITH BODY	√	√		√		
6. ONE-PIECE BALL AND STEM	√					
7. BLOCK AND BLEED	√					
8. COMPETITIVELY PRICED	√	√	√		√	√



Only FLO·BALL has all 8

In addition to these outstanding features, the **FLO•BALL** valve, with all teflon seats and seals, offers all of these advantages which make it far superior to other types of valves: fast ¼ turn, minimum pressure drop, leakproof shut-off, visible on-off indication, no backlash, and the lowest torque of any valve. The **FLO•BALL** can never stick or freeze, and it lasts longer, with less maintenance, than any other valve made.

HYDROMATICS offers the most complete line of industrial ball valves, including 1" through 14" flanged, 150#, 300# and 600#, all built to ASA dimensions. Also available: ⅛"—2" screwed end valves to 3000#.

HYDROMATICS is the world's most experienced ball valve manufacturer, having built ball valves to 10,000 psi and 14". See your local distributor for details and prices, or write to:

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FLO-BALL

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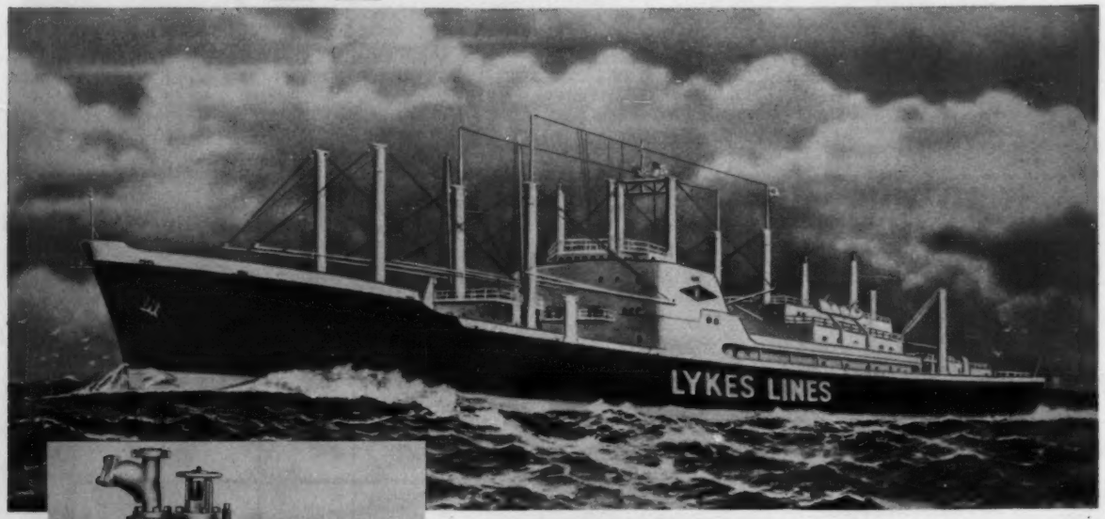
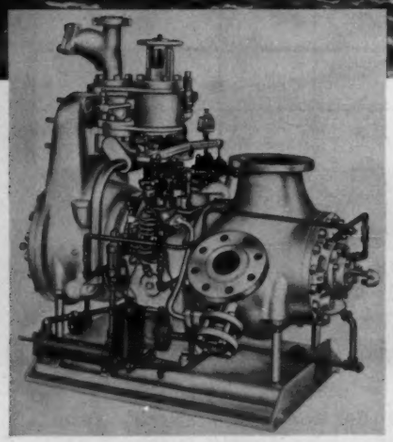
MARLIN-ROCKWELL RELIABILITY COUNTS *in* COFFIN *boiler feed* TURBO PUMPS





The fast, new Lykes Cargo Liners ply the Atlantic in coastwise shipping.

Boiler Feed Services for these 494 foot vessels are provided by Coffin Turbo Pumps equipped with MRC Precision Ball and Roller Bearings.

MRC Ball and Roller Bearings are used in a variety of marine applications. MRC engineers, with 63 years background of bearing knowledge, are prepared to discuss your bearing problems with you.

MRC pioneered, developed and produces the Super-Precision Ball and Roller Bearings, shown here, for high temperature, high speed and to provide the ultimate in accuracy and load carrying capacity.

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MARLIN-ROCKWELL CORPORATION
Executive Offices: **Jamestown, N.Y.**

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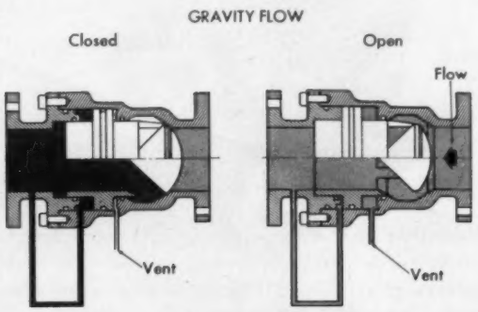
Piston Integral with Poppet

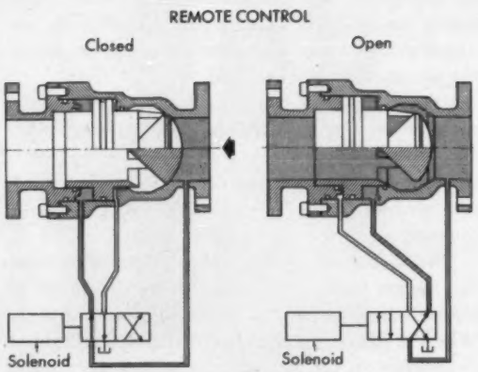
Edward W. Schrader, Western Editor

An in-line poppet, designed with an integral piston, makes a self-powered or boot-strap valve. Ports at either end of the cylinder containing the piston provide a means of actuation.

The piston is in an annular configuration about the poppet. The area of the piston relative to the poppet controls the poppet's action by differential forces. In this manner the valve may be used as a check valve.

Introduction of other valves between the line flow and either side of the piston makes it possible to use the line fluid for remote control operation.





DOWNSTREAM PRESSURE connected to downstream side of piston causes valve to operate as ladder for water flowing by gravity. Self-sensing of pressure drop across valve regulates poppet position to control flow. **REMOTE** control operation uses additional four-way, two-position valve. Upstream pressure is applied to either side of piston, thus affording on-off operation, utilizing line fluid as

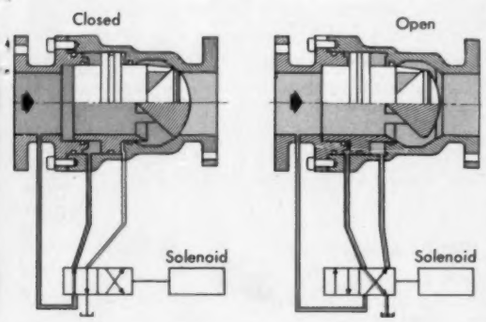
Makes Boot-Strap Valve

Control may be varied still further by using a separate fluid or media to actuate the piston completely separate from the line flow fluid. However, this would be applicable only in a case of exotic-type fuels or corrosive medium in the line and utilizing a gas or pneumatic means of valve operation.

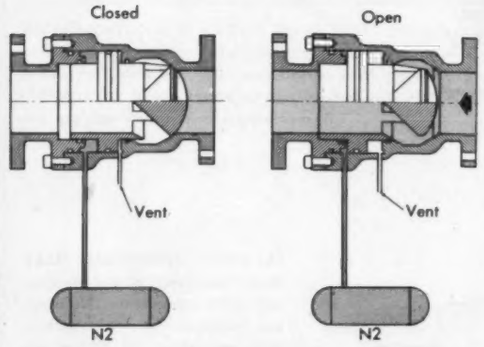
The design also lends itself to damping action by including metering orifices between the connecting ports, preventing slamming or chattering.

A patent application has been filed on the design by Densmore Engineering Co., Inc., Compton, Calif.

CHECK VALVE



CHARGED ACCUMULATOR



pressure source. CHECK valve operation uses reverse flow and additional four-way, two-position valve for remote opening. CHARGED accumulator eliminates spring rate in pressure regulator or relief valve application. Valve operates at differential pressure irrespective of flow. Tank volume is much greater than piston cylinder volume, thereby eliminating spring rate.

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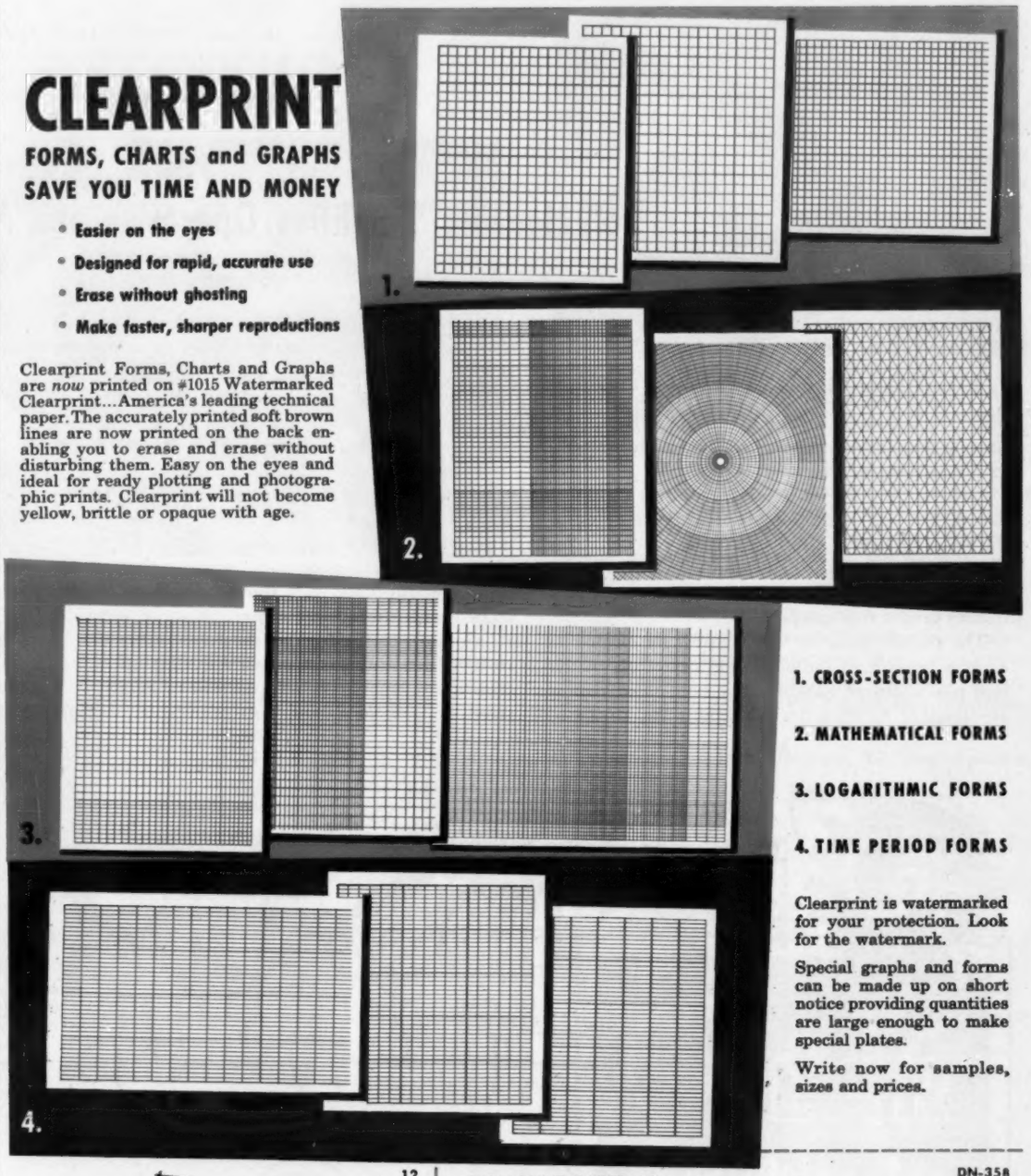

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Closed-Roll Housing Simplifies Operation and Maintenance

E. J. Stefanides, Central States Editor

A straddle-type roll housing is used in a new stretch-reducing mill for maximum rigidity and to simplify maintenance. In this design the rolls of each stand are permanently assembled in the housing and remain in the housing for the life of the rolls. All machining and size changeover is done with the rolls in the housing stands.

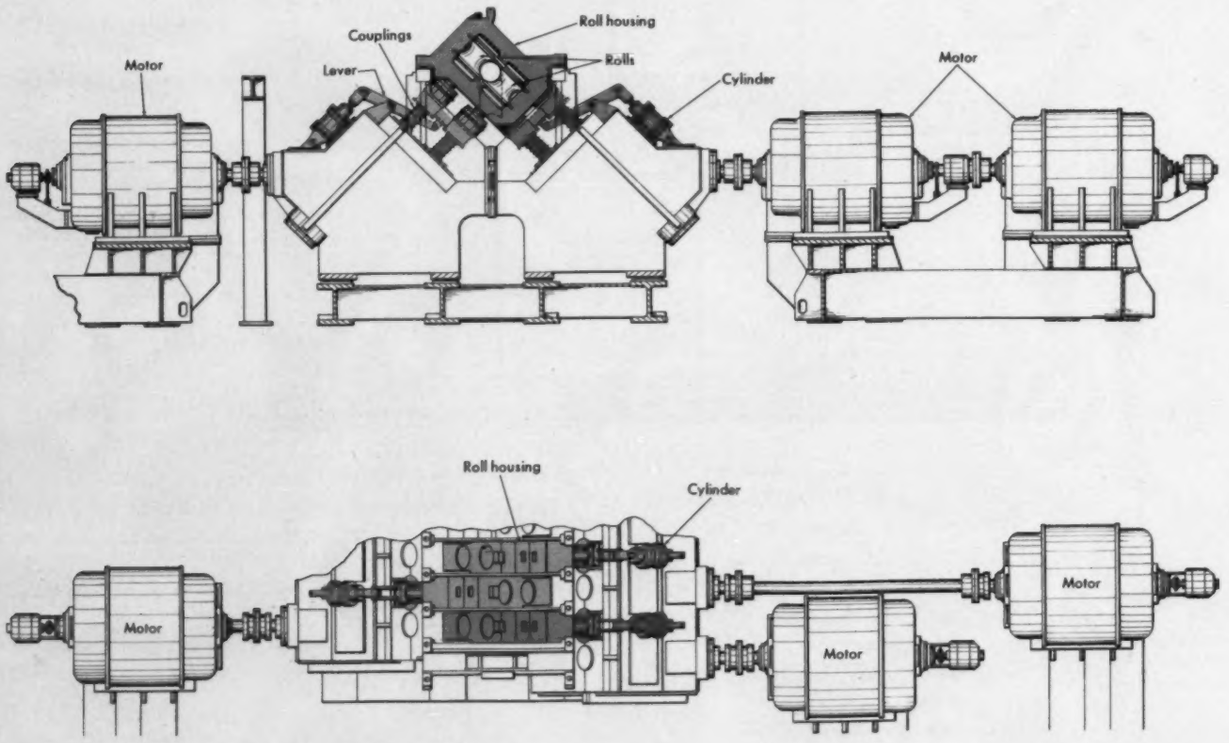
Each housing assembly consists of two cast steel halves. The roll assemblies are straddle-mounted in the housing with a fixed centerline spacing. This results in an unusually rigid unit in which all rolling forces are carried by the housing halves. It also insures proper roll spacing.

The support pads for the housing are located as close as possible to the horizontal centerline of the mill pass to insure stability. The hold-down clamps are designed to allow quick assembly and disassembly and are never removed from the base. Speed of changeover or replacement is further expedited by the use of an air-operated coupling-disconnect arrangement. These features and the elimination of roll adjustment reduce downtime to a minimum, making it possible to changeover all sixteen strands in 30-40 min.

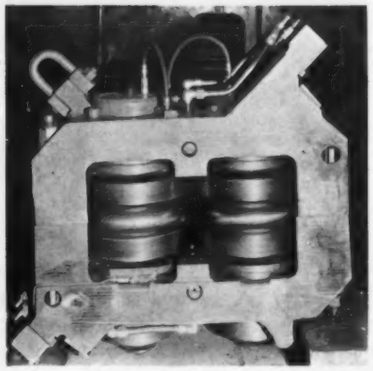
A further saving in downtime is realized in the machining of the rolls while in the housing. This is done on a special roll-pass grooving machine, which supports the housings on pads similar to those of the mill. The duplicate pads allow the rolls to be machined with the spindle centerline in an identical relationship to the rolls as the relationship of the rolls to the mill-pass centerline during operation. This insures that every roll pass will be exactly centered on the pass line, and both rolls will be matched perfectly without danger of offsets between the top and bottom rolls. To further facilitate machining of the rolls, they are rotated during grooving by a special drive on the grooving machine.

The use of the roll-grooving machine is said to reduce the actual redressing time to less than one-fourth of that normally required. It also effects a further saving in eliminating the time required to assemble, disassemble and adjust the rolls after machining.

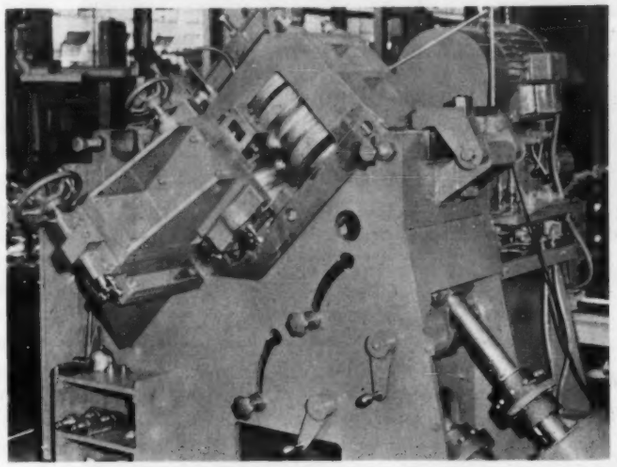
The stretch-reducing mill and the roll-pass grooving machine were designed and built by the Aetna-Standard Div. of the Blaw-Knox Co., Pittsburgh, Pa. They were shipped to Vera Cruz, Mexico, for installation at the Tubos de Acero de Mexico, S. A.



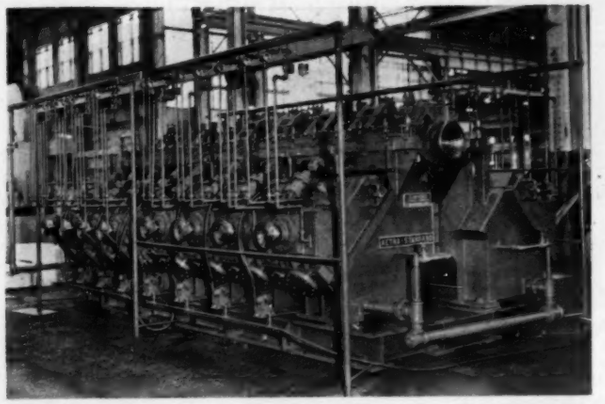
SECTION THROUGH MILL shows mounting of roll housing and drive connection. Housings are arranged in "X" pattern with centerlines at 90-deg angles. Each set of rolls is driven by one 200-hp, 600v electric motor through bevel gear drive. Rolls are coupled to drive shafts by spring-loaded splined couplings. Drive is disconnected by cylinder and lever arrangement.



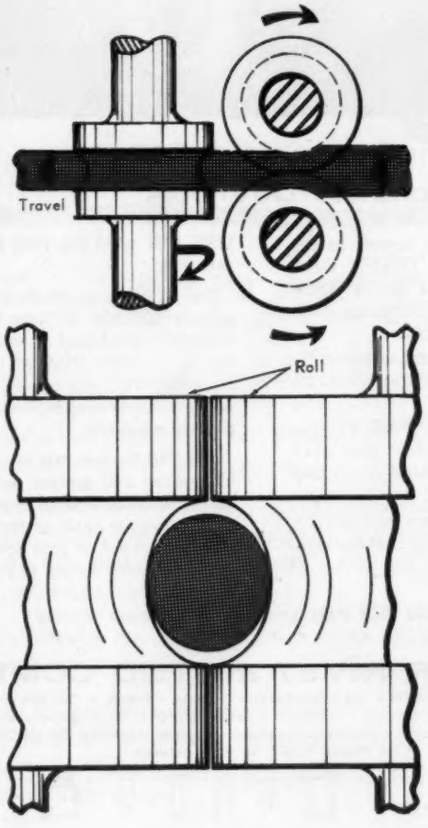
INDIVIDUAL ROLL HOUSING halves are joined by bolts and keying. Units are equipped with splined couplings and sealed bearings. Shafts and bearings are oversized to provide long life and reduced maintenance.



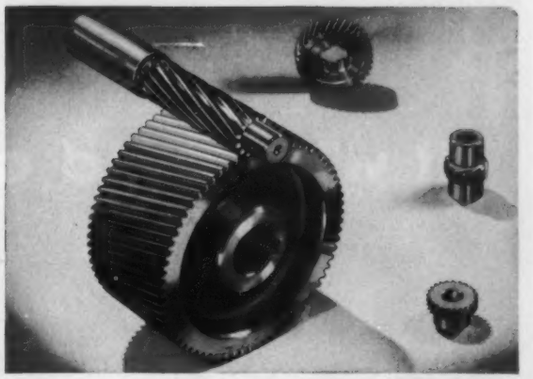
SPECIAL ROLL-PASS GROOVING MACHINE redresses rolls to next required size without removing them from housing.



SIXTEEN-STAND STRETCH REDUCING MILL reduces 6- and 7¼-inch ingoing shells to hot finished sizes, ranging from 1½-inch standard tubing to 5-inch line pipe and casing. Mill capacity ranges from 17 to 33.6 tons per hour depending on finished size. (Drive motors and spindles are not shown in this photograph.)



RELATIONSHIP OF SUCCESSIVE STANDS is shown in upper view. Roll centerlines are 90 deg to each other. Roll speed increases progressively as shell passes through mill. Bottom view shows reduction with elliptically contoured rolls.



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PAR Process thinking removed the IF ... saved 2 operations for DeVilbiss

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Riveting would overcome all the problems, cut costs and increase assembly rate by 20 percent. BUT how could a sufficiently thin, flat rivet head be had, and at reasonable cost?

An ingenious answer came from the TRS man applying his PAR Process approach to the problem. *"We'll design special jaws and a driver, and work out the feeding details so that you can feed standard oval head rivets and flatten them in the setting operation."*

It was successful! From the simplified process, DeVilbiss gets a neat saving, faster assembly and stronger fastenings that are better sealed against leakage. And, of course, rivets cost less to buy.

FIND OUT what the PAR Process can save you

The PAR Process starts with a search by your TRS man for ways to eliminate or simplify and speed up steps in assembly. It is made effective by specially organized TRS procedures, backed by unique TRS developments in rivets and riveting machines.

The PAR Process may bring you better integration and greater automation of assembly operations, or even a cost-cutting change in basic assembly method. Ask for a check of your operations . . . it can be worth dollars to you.

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If it's a Tubular Rivet TRS makes it . . . and Better

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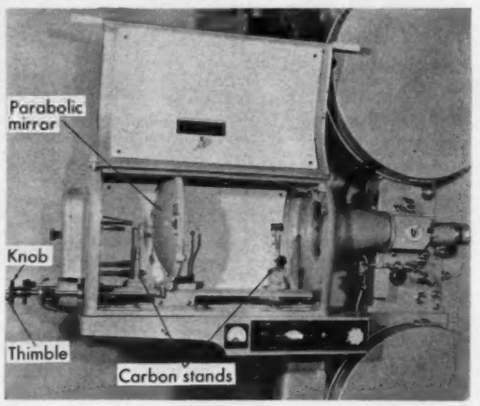
Coil Spring Forms

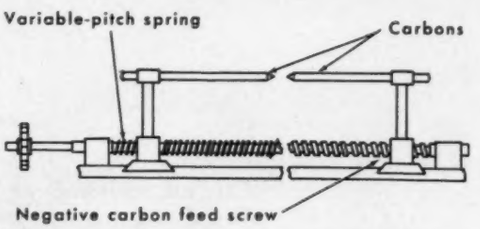
Celestino O. Lubatti, Italian Editor

A cylindrical spring of coiled square wire acts as variable-pitch screw for manual adjustment of carbon electrode feed rate in arc lamps. The spring permits accurate setting of feed ratio between positive and negative carbons to keep arc at the focus of the parabolic mirror. Design simplicity and compactness are obtained together.

A central micrometer screw changes the axial position of a winged nut compressing the spring. Spring pitch is set within limits by a thimble on the micrometer screw, in accord with the differential electrode wearing rate. This is effected by varying carbon type and size. Nonstandard female thread on the positive-carbon stand is cut shallow enough to allow proper variation of spring pitch.

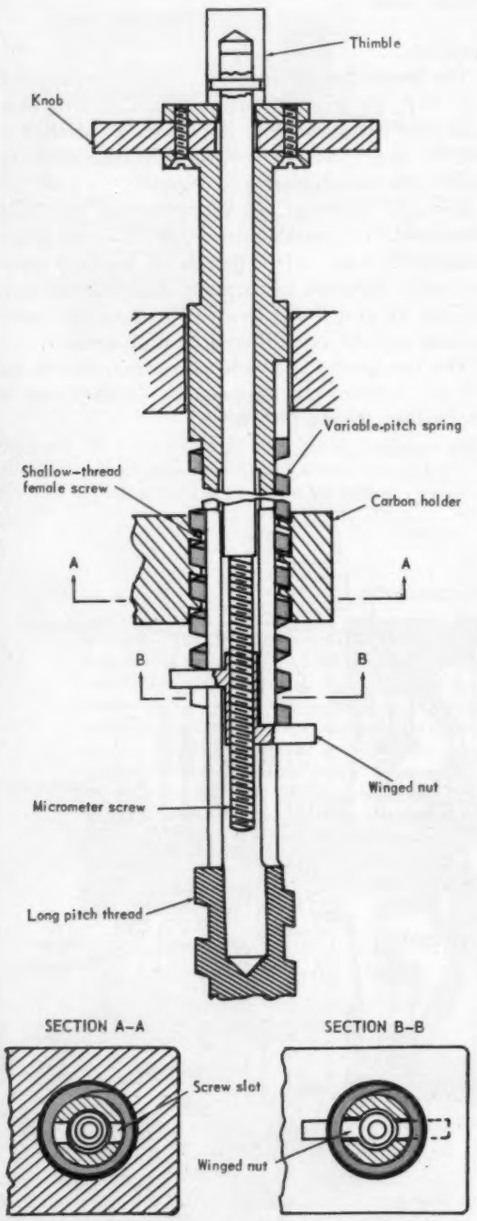
The variable-pitch screw is part of a 15-mm arc-lamp projector produced by Ditta Veronese Paolo, Milan, Italy.



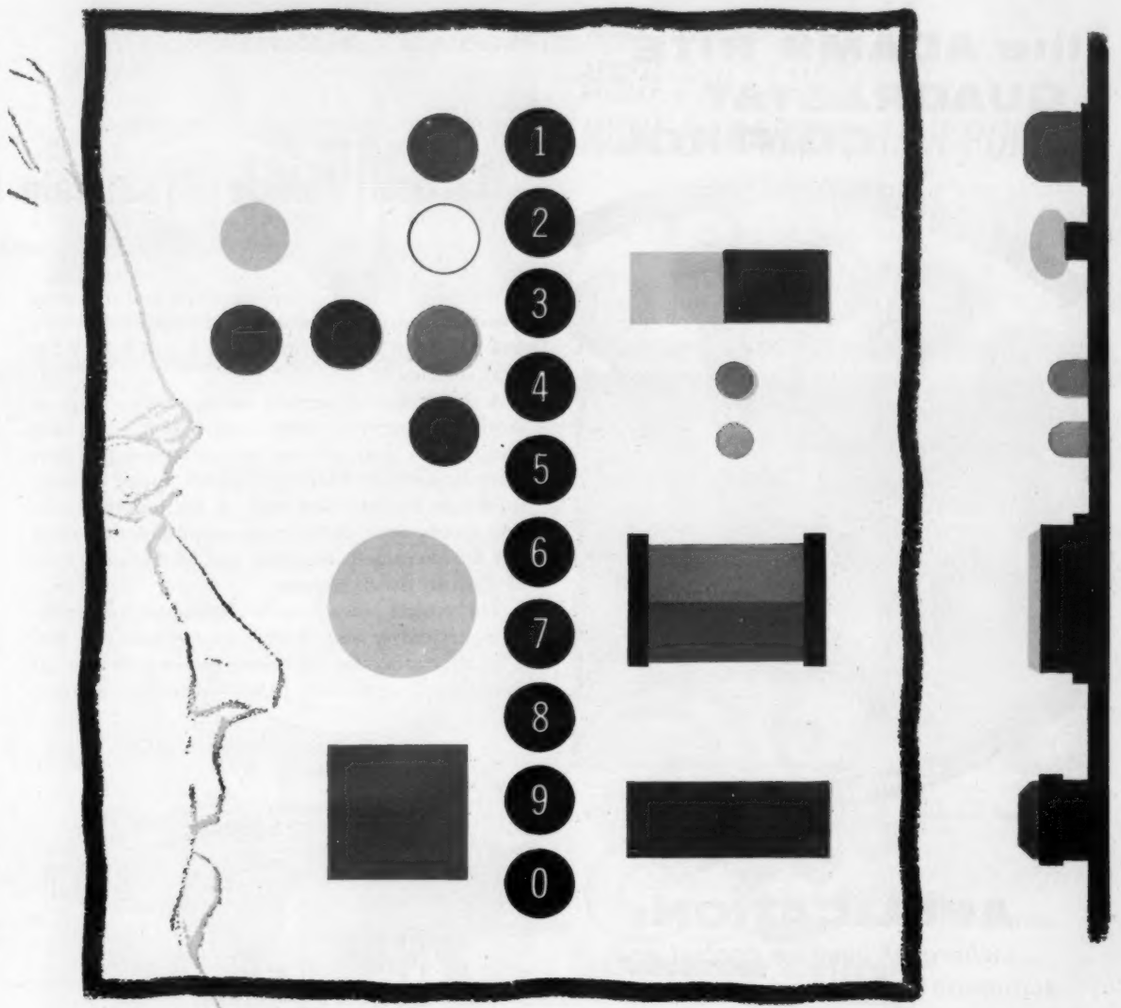


DIFFERENTIAL SCREW includes variable-pitch thread for positive carbon and fixed thread with longer pitch for negative carbon. Automatic drive or manual knob turns screw to maintain constant distance between arcing tips.

Variable-Pitch Screw



MICROMETER SCREW alters spring length and intrinsic pitch, permitting proper feed ratio and steady arcing point. Because of varying nature and size of carbons, feed ratio may vary from 1:1.5 to 1:2.4. Winged nut slides within longitudinal slot of screw.



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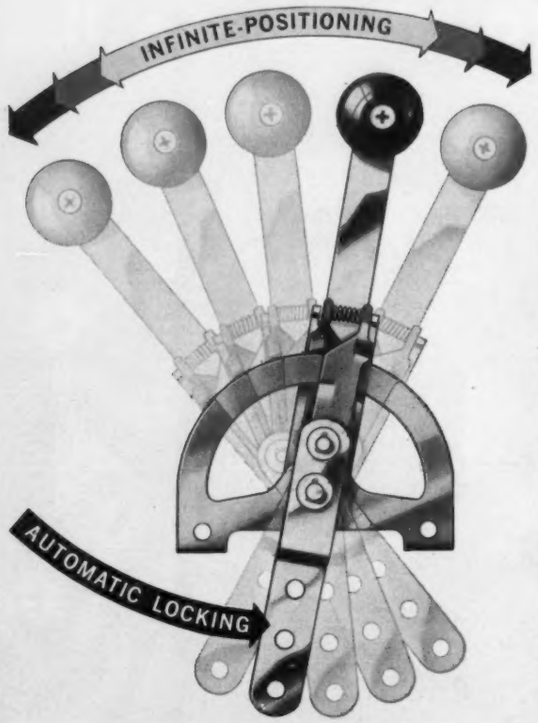

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Tactical Vehicle Powertrain Has Two-Speed, Hydraulically

Robert L. Candlish, Detroit Editor

A two-speed gear set providing direct and overdrive speed ranges is incorporated in the powertrain of a new family of medium-duty 6 by 6 and 8 by 8 tactical vehicles.

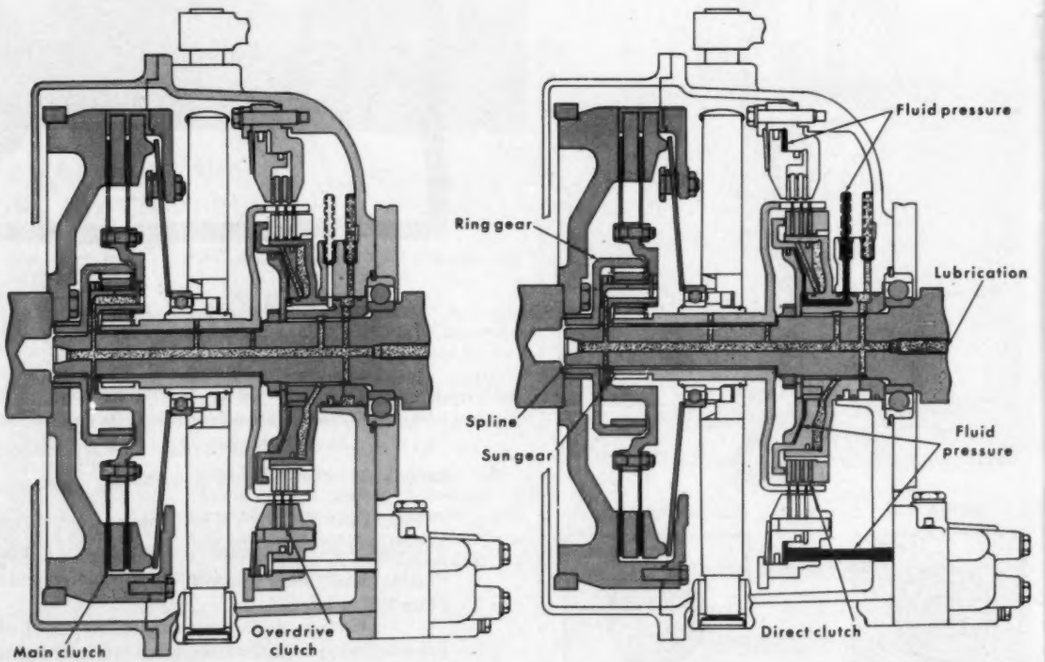
A clutch system permits the operator to up- or down-shift between direct and overdrive in any transmission gear at any vehicle speed and any throttle position. Thus, two speeds, direct or overdrive, are available for each of the four transmission speeds. Split shifts are accomplished hydraulically by alternately engaging and disengaging each of the two clutch systems.

The vehicle powertrain is engineered for 10,000-mile service-free and 20,000-mile overhaul-free life. The air cleaner for the diesel power unit and air pump is a dry-type with 10,000-mile normal replacement life.

The main transmission is a fully synchronized unit with air-powered manual shift. Power flow from the transmission to the axles is through a transfer case, rubber-mounted, amidship. Drive to the front wheels is manually engaged.

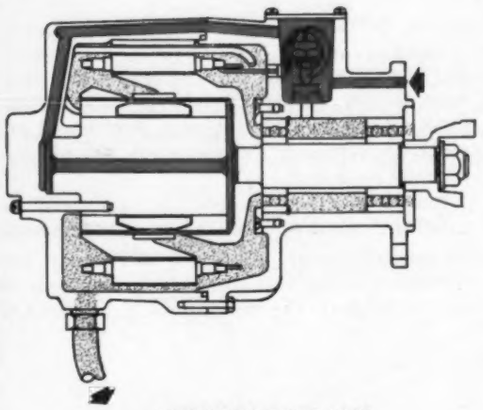
Driveline universal and slip joints are positively lubricated. Differential carrier assemblies are interchangeable in any axle. The exhaust system is stainless steel. Extensive use is made of aluminum castings for the clutch and flywheel housing, the transfer case and the axle differential drop boxes.

The two-speed clutch and powertrain system for military vehicles was designed by GMC Truck & Coach Div., Pontiac, Mich.



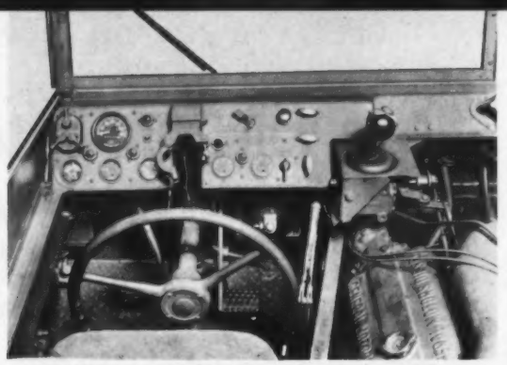
CLUTCH ASSEMBLY consists of dual-plate wet-type main clutch driving carrier of planetary gear system plus direct or overdrive clutch controlling planetary gear set through sun gear. Planetary ring gear is splined to transmission input shaft. In direct drive, direct clutch couples sun gear to the transmission input shaft locking up the planetary set. Drive from main clutch is direct to transmission input. In overdrive, sun gear is grounded out through overdrive clutch to transmission case. Overdrive action is obtained by pinion gears rolling on locked sun gear which overdrives ring gear splined to transmission input shaft. Fluid pressure to operate clutches and for lubrication is by gear pump on rear of engine. Button on gear-shift lever operates solenoid valve for clutch shifting.

Operated Clutch

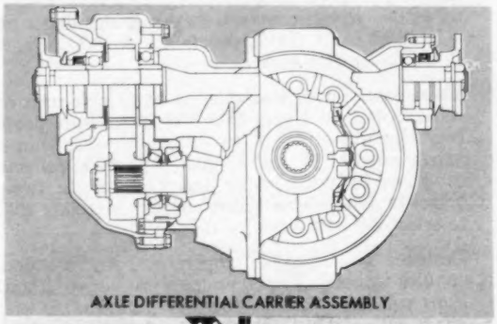


OIL-COOLED GENERATOR

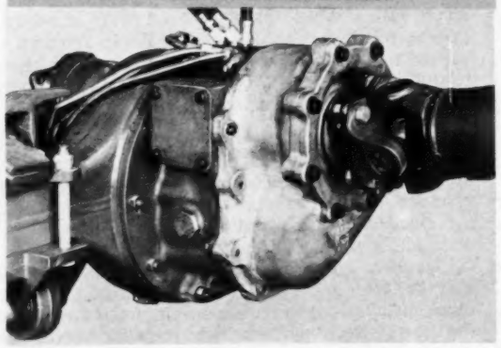
BRUSHLESS-TYPE GENERATOR is flange-mounted 24v and driven from engine blower at 2.5 times engine speed. Lubrication and cooling is by engine oil system.



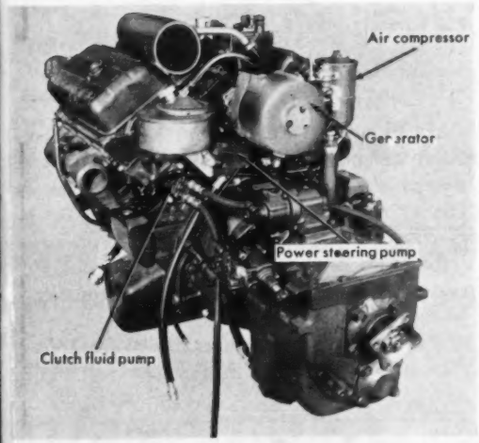
ADJUSTABLE STEERING COLUMN can be positioned up or down, fore or aft, or folded on seat to reduce shipping height. Power steering is standard on 8 by 8 and optional on 6 by 6.

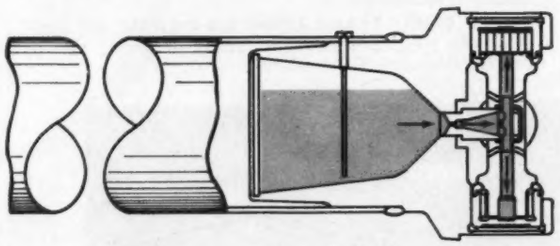


AXLE DIFFERENTIAL CARRIER ASSEMBLY



HYPOID-TYPE AXLES have single reduction with drop box at front. Housings are bowl-type with differential carrier mounted near center. Positive ventilation by air system removes moisture. Automatic traction equalizer device of limited-slip, multiple-disc type is used on all axles to deliver most torque to wheel with best road adhesion. Front axles are driving-type with axle shaft and universal-joint assembly enclosed within steering knuckle support at outer end of housing.





METERED LUBRICATION is automatically supplied to propeller-shaft sealed needle-bearing universal joints and slip coupling from wells in shafts.

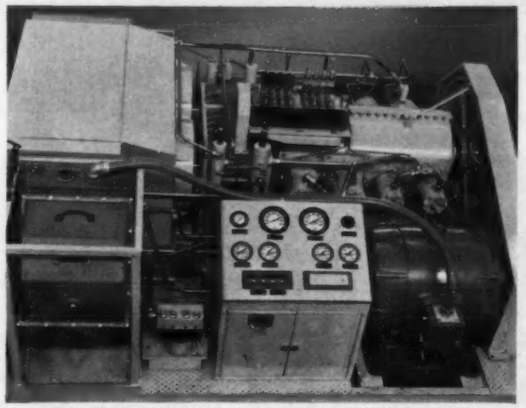
TWO-CYCLE 318.6-CU-IN DIESEL ENGINE supercharged by Roots blower produces 190 hp at 2800 rpm. Torque rating is 412 lb-ft at 1300 rpm.

When You Need

HIGH PRESSURE
HIGH CAPACITY, HIGH PURITY

AIR, HELIUM NITROGEN

FOR COMPONENTS TESTING OR PRODUCTION



MODEL DPB-CCS Four-stage, 8-cylinder compressor. System includes full dehydration and oil removal, filter and complete control panel. Backed by Cardair's 20 years of high pressure gas experience. The only ICBM type compressor qualified by 2500 hour life test.

CCC CARDAIR CENTRAL COMPRESSION SYSTEMS

Guarantee Delivery

- up to 12,000 psi continuous
- with less than 1 ppm oil content
- 150 SCFM @ 128 psig intake • dewpoint −100°F.

Developed and qualified as GSE equipment for ICBM program—now available from stock or programmed production!

Most recent broad purpose Central Compression System in the Cardair line, the Model DPB-CCS is a semi-portable, skid mounted unit, ready to install on location in less than a day. Only electrical and high and low pressure connections are needed.

In addition to air, helium and nitrogen, it can be easily adapted to other gases including hydrocarbons and hydrogen. Pressure range is from 3500 to 12,000 psi in continuous service and to 15,000 psi intermittently. Complete dehydration and oil removal equipment are included.

For either testing or production, it may also be used as a central high pressure source for diverse locations, with Cardair supplying the complete system.

Maintenance is simple and minimal, with nationwide Cardair service facilities. Installation is easy—no heavy concrete base is required.

Write today for illustration sheet and technical data—or send us information on your particular high pressure supply needs.

CARDAIR
DIVISION OF MARMON-HERRINGTON COMPANY, INC.
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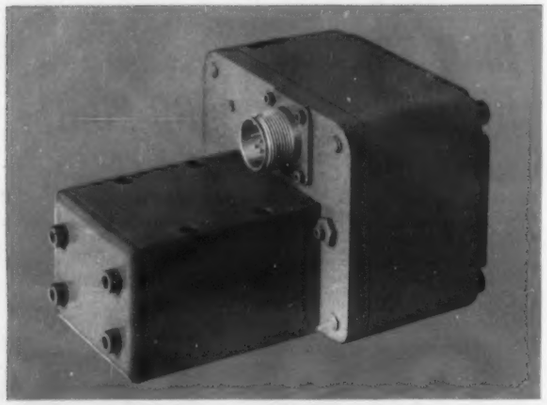
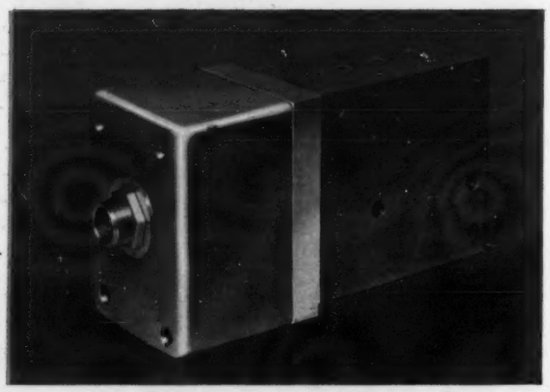


NEW series SC4 single stage servo valves are latest additions to the complete Vickers line. Rated at 0-3 gpm, they combine high performance with flexibility and ruggedness.



Two complete series of two-stage valves cover system requirements from 0-17 gpm and 0-37 gpm. With several models in each series, system needs can be precisely satisfied.

Servo Valves To Match Your SPECIFIC Needs

Ruggedness, dirt tolerance, reliability, low cost and compatibility with standard hydraulic components featured in complete line

Extremely accurate flow modulation for fast, precise closed-loop control of position, velocity, and acceleration is offered in the complete line of Vickers servo valves. They are specifically designed for industrial applications with a range from 0 to 37 gpm.

Low cost of all servo valves in the line is the result of being designed for production economies. In addition, the inherent simplicity of the Vickers design pays off further when occasional service or cleaning is needed —in most cases the valves *do not have to be returned to the factory for service.*

Three Basic Series Available—A new single stage design rated from 0 to 3 gpm with 350 psi pressure drop, and two separate series of two-stage variable gain servo valves rated to 17 and 37 gpm, with 1000 psi pressure drop, are included in the line. Each of the two-stage valves is available in several models enabling the user to select the best valve for the job.

Designed To Take It—Temperature, dirt and vibration conditions normally encountered in industrial applications will not affect accuracy or performance of these servo valves when they are used with standard, 10 micron full flow filters. Both the single and two stage valves are equipped with large industrial, high force torque motors and will not clog or stick when operated with clean industrial hydraulic oils.

Part of Complete Line—Of equal importance for continued system accuracy and reliability, these servo valves are part of the complete line of high quality hydraulic products available from Vickers. Thus, responsibility for efficient operation of the entire hydraulic system rests with a single source.

Complete pre-engineered servo systems using the Vickers "Building Block" concept can be provided for many installations to reduce development and engineering costs. Such systems can include: servo valves, motors, hydraulic power supplies, electronic amplifiers, electrical feedbacks, etc.

Your nearby Vickers application engineer will assist you with your specific requirements or write, wire or call for Bulletins 59-74, 61-79.

VICKERS®

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

Machinery Hydraulics Division

ADMINISTRATIVE and ENGINEERING CENTER

Department 1504 • Detroit 32, Michigan

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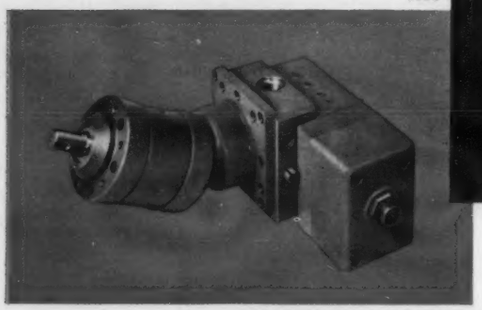
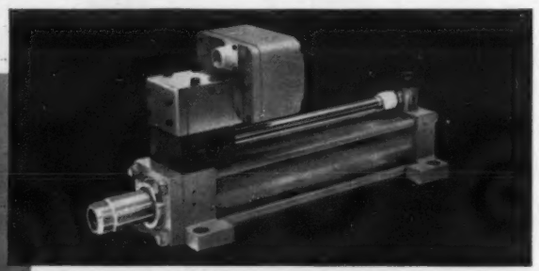




Servo valves can be mounted separately or combined in one package with Vickers servo motors or hydraulic cylinders. All components for a complete system—either custom engineered or "Building Block"—are available from Vickers.

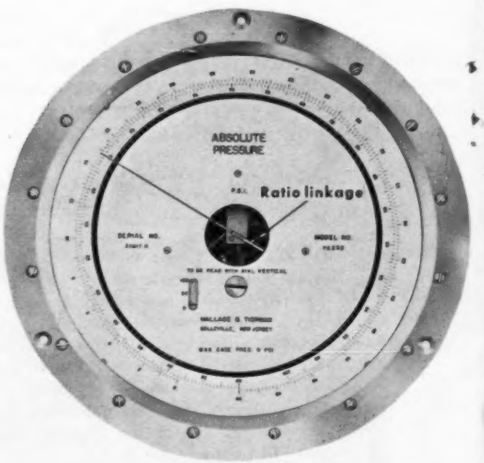
Circle 18 on Reader-Service Card for more information

Ratio Linkage

Victor W. Wigotsky, Eastern Editor

A new pressure gage uses a ratio linkage to resolve motion of absolute reference and system-pressure Bourdon tubes. Design provides an absolute pressure gage for up to 500 psia without necessity for a sealed case.

Ranges to approximately 150 psia could be handled conveniently with an evacuated capsule reference. However, for the higher ranges it was considered undesirable and possibly dangerous to use this method. The two Bourdon tubes, hooked together by a ratio linkage, provide a compact and safe design. Pressure is now contained in 8 cc instead of the 3000-cc average case volume.



SAME MECHANISM IS USED FOR GAGE PRESSURE READINGS, except that only one Bourdon tube is required for measuring system pressure. "NiSpanC" is used for tube material to eliminate temperature effects and provide corrosion resistance. Unit is accurate to 0.1 percent of full scale.

The unit resolves two movements, one being proportional to system and atmospheric pressure and the other proportional to only atmospheric pressure. Their net movement is then proportional to the desired absolute pressure.

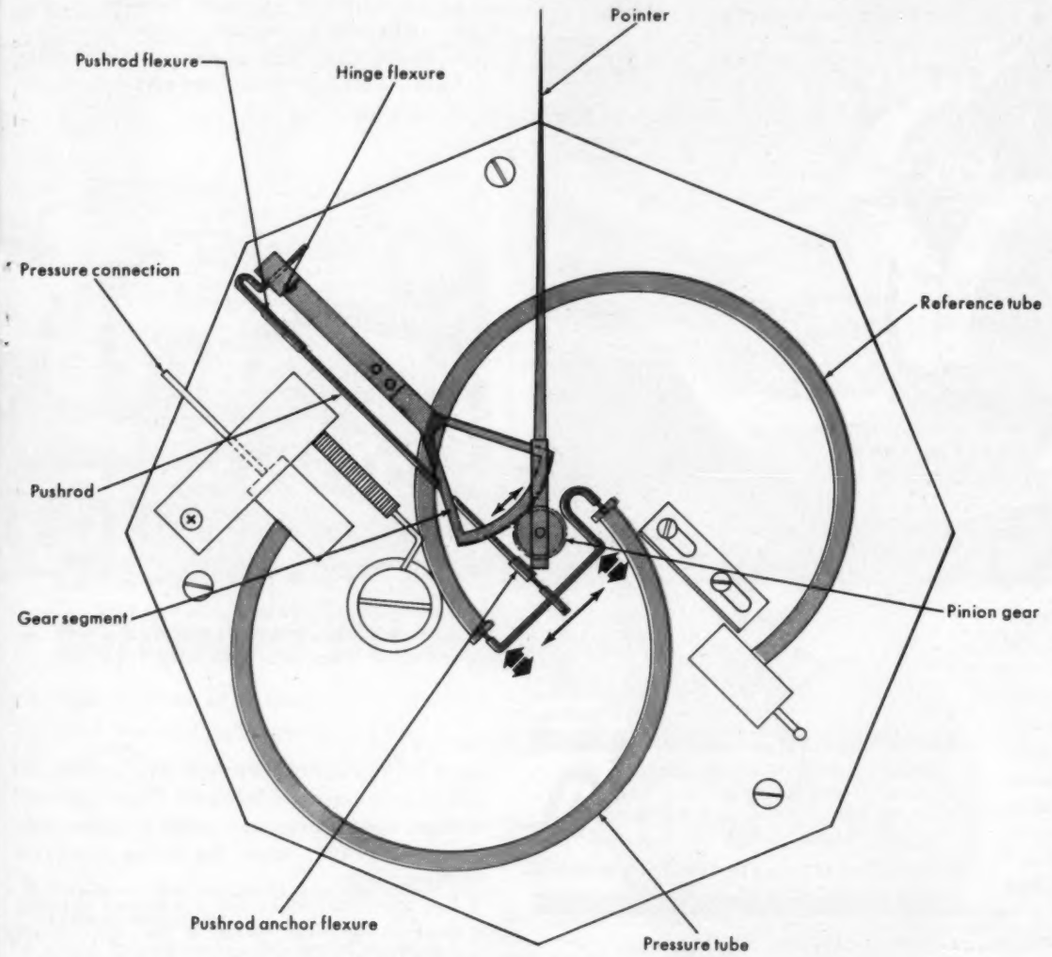
A gear system provides a 3/32-inch linear input from the resolving linkage for full-range

Couples Two Bourdon Tubes

pointer output. Full range input to the linkage is then 3/16 inch because of a 1:2 linkage ratio.

Lateral adjustment is provided at the junction of the pushrod and linkage, since it is difficult to assure that the two Bourdon tubes will have exactly the same tip travel. The resolving linkage then also functions as a compensating linkage in order to produce the same pointer movement, whether a given pressure change occurs on the line pressure or absolute pressure tube.

The new pressure gage was designed by Wallace & Tiernan, Inc., Belleville, N. J.



ATMOSPHERIC PRESSURE IS ADMITTED through opening in case and surrounds both tubes. Increase in line pressure causes pressure tube to expand and its tip to move parallel with pushrod and away from hinge end of gear sector. Pushrod motion causes pushrod flexure and hinge flexure to bend, swinging gear segment with mating pinion through an arc to move pointer. Assume, then, that line pressure stays fixed and atmospheric pressure increases. Pressure tube would contract. At same time, reference tube, similarly affected by change in atmospheric pressure, causes linkage to pivot in opposite direction about tip connection of pressure tube. Net movement applied to pushrod will then be zero. Since tube spring rates are seldom identical, these variations are compensated by varying linkage ratio.

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Producers of the AIRWIN line of Rubber Products

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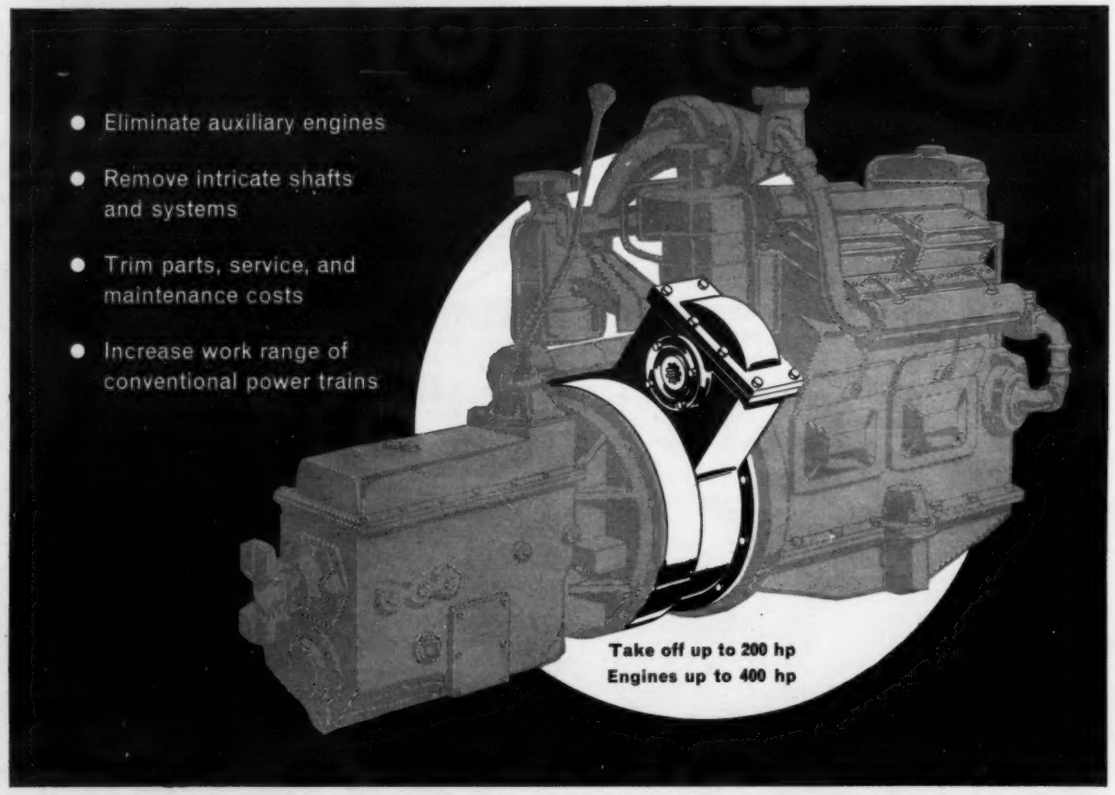
NEW Four ways you can save with a Cotta heavy-duty flywheel power take-off


Eliminate auxiliary engines
Remove intricate shafts and systems
Trim parts, service, and maintenance costs
Increase work range of conventional power trains
Take off up to 200 hp
Engines up to 400 hp

Now you can take 175 to 200 hp direct from engine flywheels, boost heavy equipment productivity, *and* eliminate direct and indirect costs of conventional PTO designs.

You can increase versatility of these and similar machines: heavy construction equipment, airport utility vehicles, fire trucks, generators, auxiliary hydraulic equipment, air compressors, and drills.

Simple installation fits a Cotta heavy-duty PTO between master clutch and flywheel of engines rated up to 400 hp. Even when clutch is disengaged, you can take off power at 1.24:1 ratio. Standard mounting — front and rear — with SAE No. 1 or No. 2 bell housings. Rotation at 30° increments positions unit for your specific job.

Save maintenance time and costs. Only 12¼" additional length on power train replaces auxiliary engines, shafts, joints, and couplings of conventional systems. One-piece cast housing endures heavy shock loads.

Cotta also customizes standard transmissions to individual applications . . . input torques from 150 to 2,500 ft-lb . . . single-speed, multispeed, and right-angle drives . . . variety of mountings.

For details, call Cotta (TWX-RK-7720; phone WO 4-5671) or mail coupon.

COTTA
HEAVY-DUTY TRANSMISSIONS.

Cotta Transmission Co., Rockford, Illinois
Please send details on:
☐ New Cotta Flywheel Power Take-off
☐ Standard Cotta Transmissions customized to each application
Name
Title
Company
Address
City Zone State

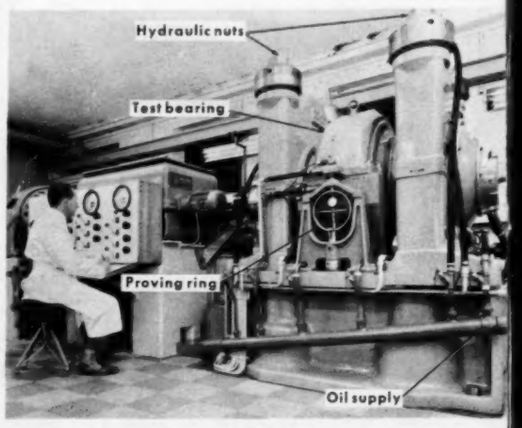
Circle 20 on Reader-Service Card for more information

Hydraulic Jack

Volrath Holmboe, Correspondent in Sweden

A nut comprising three separately movable parts acts as a hydraulic jack to facilitate achievement of high final tension in a bolt, without excessive torque application. The device is relatively simple in design, cheap in construction and practical in operation.

An internally and externally threaded flanged sleeve is screwed on the bolt over a cup-shaped part. Sleeve flange and cupped part fit together to form a hydraulic piston and cylinder, respectively. O-rings seal the unit. When cup and sleeve have been drawn down against the fixed machine element, and oil pressure is applied to the space between cup and flange, the bolt is tensioned correspondingly.

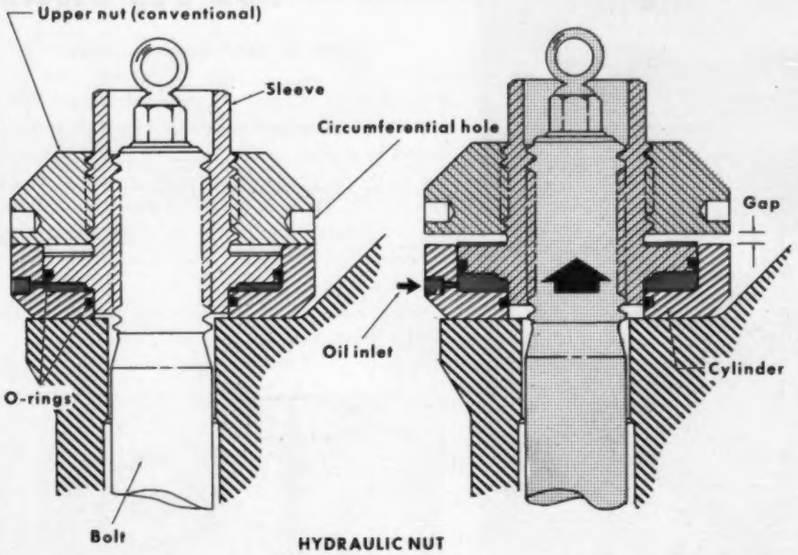


ORIGINAL APPLICATION was on large roller-bearing testing machine. High tensions were required to keep cap halves together under radial loads of up to 600 tons.

The third part looks like a common nut and is spun on the outer thread of the sleeve. Since it is not under load, it is simply turned down until it contacts the axial face of the cup. Upon release of oil pressure, almost the entire previously attained bolt tension is maintained.

These nuts were designed and built by SKF Svenska Kullagerfabriken, Goteborg, Sweden, as part of a heavy machine for testing theories relative to very large-diameter roller bearings.

in Three-Part Nut Easily Boosts Bolt Tension



HYDRAULIC NUT

HYDRAULIC NUT produces high bolt tension without heavy wrenching efforts. Sleeve and cupped cylinder are positioned without resistance. Sleeve remains in contact with machine bed at all times, while oil forced between cylinder and flange on sleeve elongates bolt with tension. Upper "nut" is similarly spun down without load, but maintains practically full tension upon release of pressure.

Decco INDUSTRIAL SOLENOIDS

the dependable answer to your solenoid problems!

- Highly resistant to moisture.
- Shock mounted for longer service life.
- Develop 2 to 30 pounds push or pull.
- Available in AC or DC models.
- Compactly designed from the best, top quality materials.
- Giants or tiny miniatures, multi-million cycle performance.

A model for your every need. Special solenoids may be engineered to suit special applications.

Tempered steel spring absorbs vibration, holds assembly firmly in alignment.
Striker plate of non-magnetic stainless steel.
Highly efficient silicon steel laminations.
High flow-point molded nylon bobbin, wound with heavy Nyclad insulated magnet wire.
Hardened beryllium copper plunger guide reduces friction and wear.
Shock absorbing bumpers cushion the stroke, assure longer service.

DETROIT COIL COMPANY

2435 HILTON ROAD, FERNDALE 20, MICHIGAN

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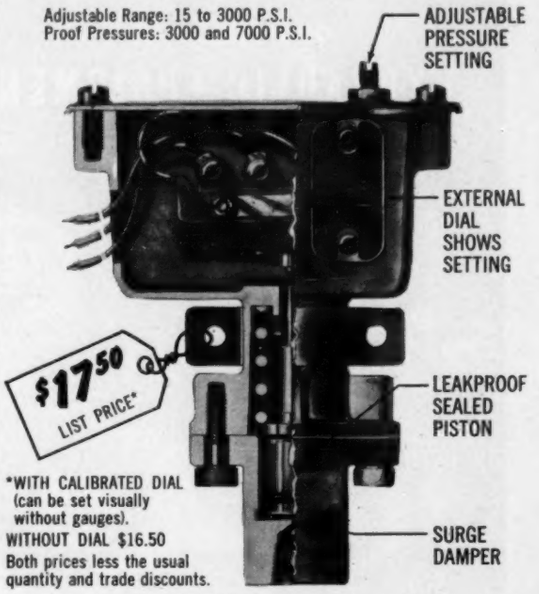
ONLY This Pressure Switch Resists 7000 p.s.i. Surges and Stays Accurate within 2%

Adjustable Range: 15 to 3000 P.S.I.
Proof Pressures: 3000 and 7000 P.S.I.



*WITH CALIBRATED DIAL (can be set visually without gauges).
WITHOUT DIAL $16.50
Both prices less the usual quantity and trade discounts.

WE BUILD IN	WE DON'T USE
RUGGEDNESS CAN TAKE SURGES (High proof pressures) CONTINUOUS OPERATION (Millions of cycles) NO STICKING (in dirty fluid)	LINKAGES & BEARINGS WHICH WEAR QUICKLY (cause settings to drift and switch to fail).
LABOR & MATERIAL SAVINGS NO RETURN DRAIN PIPING (Sealed piston) MOUNTS WHERE CONVENIENT (Operates in any position, not sensitive to vibration)	UNSEALED PISTONS WHICH ADD TO YOUR INSTALLATION COST (return piping).. ARE CRITICAL TO DIRT (pistons get stuck).

Send for FREE catalog 9-PS.

PRESSURE SWITCH DIVISION

barksdale valves

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In short, this new manufacturing operation provides the most efficient production facilities and flow for the manufacture of hydraulic equipment. It's one of several ways in which Hydreco serves you better!

HYDRECO® DIVISION
THE NEW YORK AIR BRAKE COMPANY
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PUMPS

VALVES

MOTORS

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360-Deg Steering

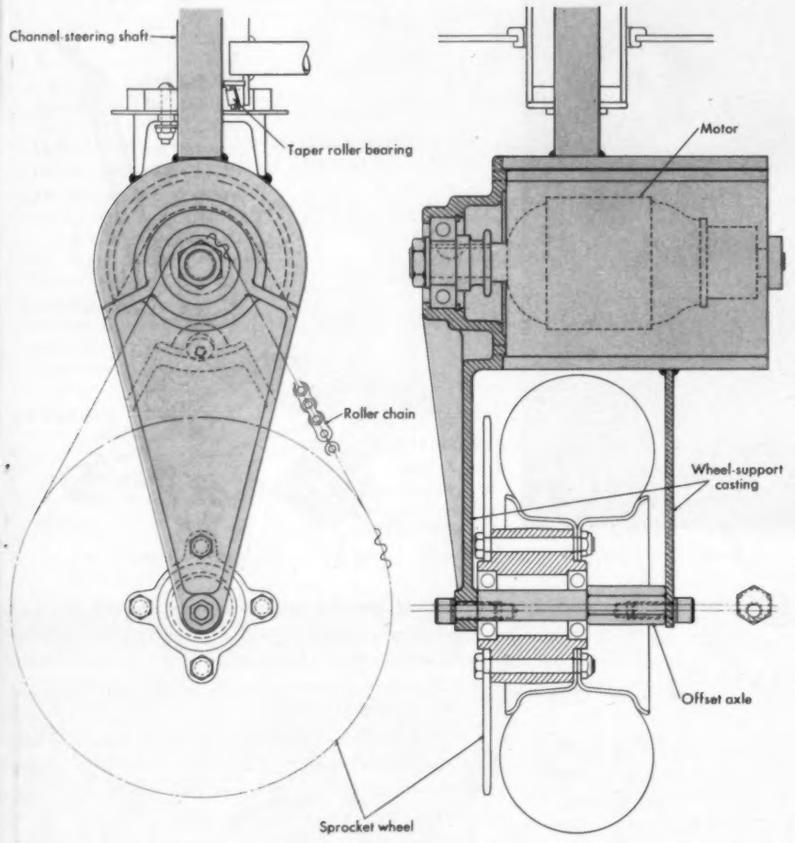
Robert L. Candlish, Detroit Editor

Full pivot of front steering and driving wheel of a three-wheel vehicle developed for solo transportation in a plant area eliminates the requirement for a reverse gear and permits operation in confined areas. Drive is by 24v electric motor from a battery power source. Low and high speed ranges are obtained by direct switching of a stepped rheostat.

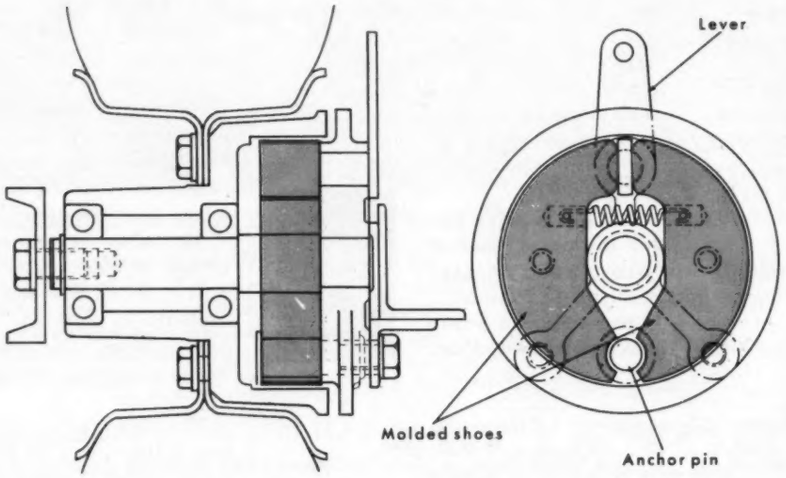
The "Kasper Kar" is a product of Kasper, Inc., South Bend, Ind.

ONE-PIECE REINFORCED FIBER GLASS BODY, removable for access, is mounted on welded-steel frame. Formed-channel structure on outside offers complete wrap-around bumper protection. Two standard 24S 12v batteries, supplying current for 24v drive motor, are low mounted over the rear axle for high stability. Key lock and four-prong polarized charger receptacle are included in electric system. Car will climb 15 percent grade and make 180-deg turn in 39-inch aisle.

Eliminates Reverse on Industrial Personnel Car



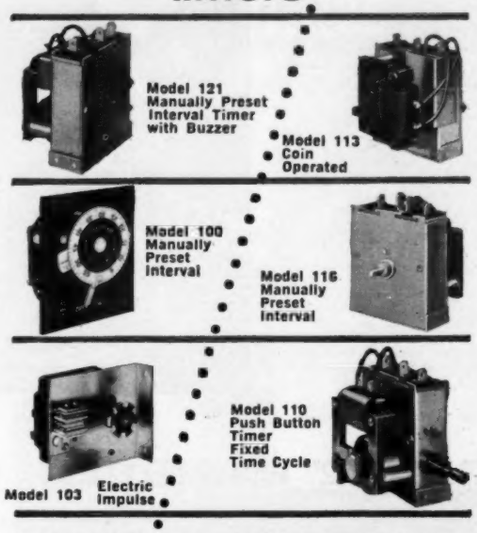
ELECTRIC DRIVE MOTOR HOUSING is functional part of front-wheel mounting structure. Wheel-support casting holds motor shaft outboard bearing, absorbing drive-chain load. Section of channel is welded to motor housing to provide proper support for steering arbor and to distribute load to housing. Arbor rotates on taper roller and sintered-bronze bearing in steering-column tube welded into car frame. Drive-chain tensioning is controlled by position of offset axle turned from hex stock. Hex provides rapid adjustment of axle position. Motor current is carried by grounded frame, and full slip ring permits 360-deg steering.



MOLDED SHOES for two-shoe internal expanding brakes on both rear wheels function as both shoe and lining. Number of independent pieces required is minimum. Formed ends seat against anchor pin and also act as cam surface against actuating lever. Press-fit pins hold shoe retraction springs. Brake drums are cast iron.

WIDE-RANGE SELECTION

assured with MILLER-HARRIS field-proved timers


Model 121 Manually Preset Interval Timer with Buzzer
Model 113 Coin Operated
Model 100 Manually Preset Interval
Model 116 Manually Preset Interval
Model 110 Push Button Timer Fixed Time Cycle
Model 103 Electric Impulse

APPLICATION-ENGINEERED FOR *YOUR* PRODUCT

Miller-Harris offers product designers a wide choice of dependable, high-quality timers. From field-proved "Standards" to completely different "Specials," you will be sure of getting the precise timer best suited to fill your product improvement and cost-saving needs. Whatever your control timer requirements may be, you owe it to yourself and your company to know how Miller-Harris will serve you better.

Write or call for Miller-Harris illustrated brochure

MILLER HARRIS ELECTRIC CONTROLS

MILLER-HARRIS INSTRUMENT CO.

1140 SOUTH 1ST STREET • MILWAUKEE 4, WISCONSIN

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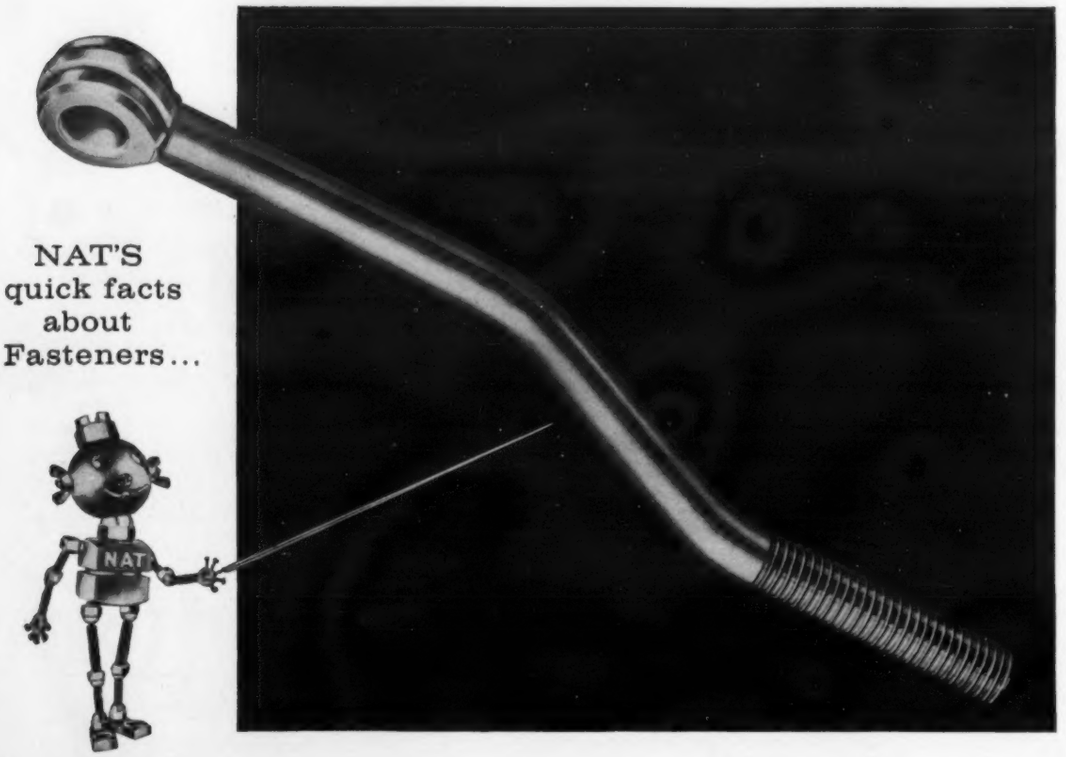

Shining example...of big things in **specials** by National

This is a large offset eyebolt, shown here big as life. We designed and made it to order for one of our customers.

To begin with, it shows that we can and do make some sizable things in the way of cold headed Special Products.

But there's more here than seems to meet the eye.

When our customer brought us this eyebolt, he had been having it made as a forged eye welded to a machined bolt, with a cut thread.

We gave it some thought, then made it... with a difference. We cold formed it in one piece, and rolled the thread... turning out a stronger, more practical, and more efficient part, and lopping off costs all along the line.

And there's the real point... what we really mean when we mention doing BIG things in Specials, at National... better parts, large or small, at lower cost, by cold heading and designing for profit.

We do it right along, and we can very likely do it for you, too. Want to find out? Just drop a note to Special Products Service, at our address*. And if you just happen to have a Special problem, tell us all about it—and let us help.

*It will bring you this illustrated booklet "Bring your Special Problems to National", 16 pages about Specials as National sees them.

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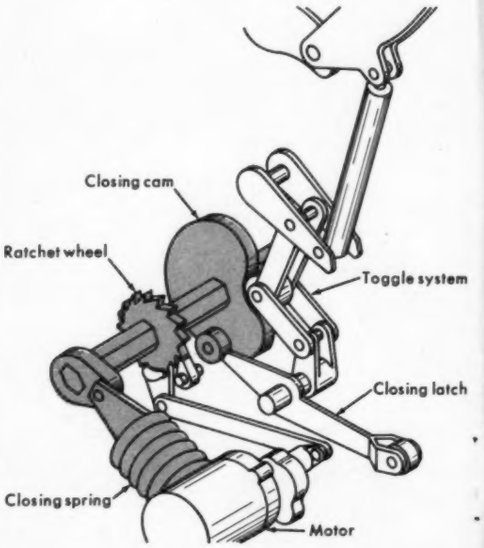
Stored-Energy Breaker Closure

Paul R. Taylor, Assistant Editor



A circuit breaker using a motor-powered charged spring mechanism provides constant and uniform contact closure. This stored energy closure method improves contact life and affords greater safety for personnel.

Conventional closure methods use magnetically operated solenoids to activate a plunger. A spring with stored energy is inherently faster, since activation time is dependent solely on the forces stored in the spring and the inertia of the system. Since gravity is not a factor in contact opening, the mechanism may be operated in any physical position.

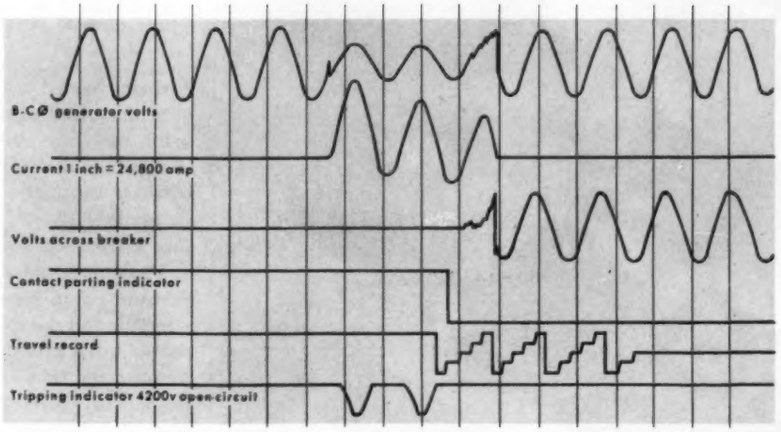
The high-power spring, deliberately overdesigned, stores energy supplied by a high-torque motor, through a simple ratchet and pawl assembly. Excess energy not used in the closing operation is stored in the spring as a partial recharge for its next operation.

The motor and ratchet arrangement provides utmost simplicity and long life. A skip-tooth ratchet allows free wheeling. The motor is not subjected to sudden jolts or shocks produced by sudden stops. The system uses no clutches or brakes and introduces no complicated motor cut-off problems.

The stored energy closure was designed into the new 5 HK circuit breaker and switchgear by the I-T-E Circuit Breaker Co., Philadelphia, Pa.

Improves Contact Life and Safety

STORED-ENERGY in springs closes breaker contacts. Charged through ratchet and pawl system, either manually or by small a-c/d-c motor, springs are held in charged position by set of latches. Releasing latches—either through manual firing lever or by energizing small closing coil—allows springs to release energy and, by operating on toggle system, lift jackshaft. Lifting jackshaft not only closes contacts but also charges springs that open contacts when breaker receives trip impulse.



OSCILLOGRAPHIC RECORDING illustrates rapid movement of arcing pattern from contacts to interrupter plates. This is indicated by time interval between arcing contact parting indication and appearance of voltage across breaker. Time interval between any two vertical lines is 0.01 sec. The 5 HK-250 breaker interrupted symmetrical current of 22,700 amps, asymmetrical current of 32,200 amps at average recovery voltage of 5.26 kv. Current interruption takes place in approximately 0.012 sec.

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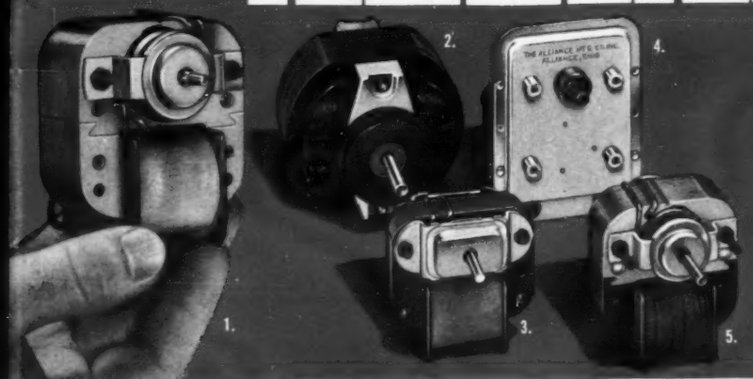

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H	117	1.0	.31	17	2500	1 Lb. 6 Oz.
JSG	117	225	.49	25	12-14	1 Lb. 7 Oz.
JS	117	2.70	.67	42	2900	1 Lb. 13 Oz.

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Working Pressure Shifts

Ronald W. E. Martin, British Editor

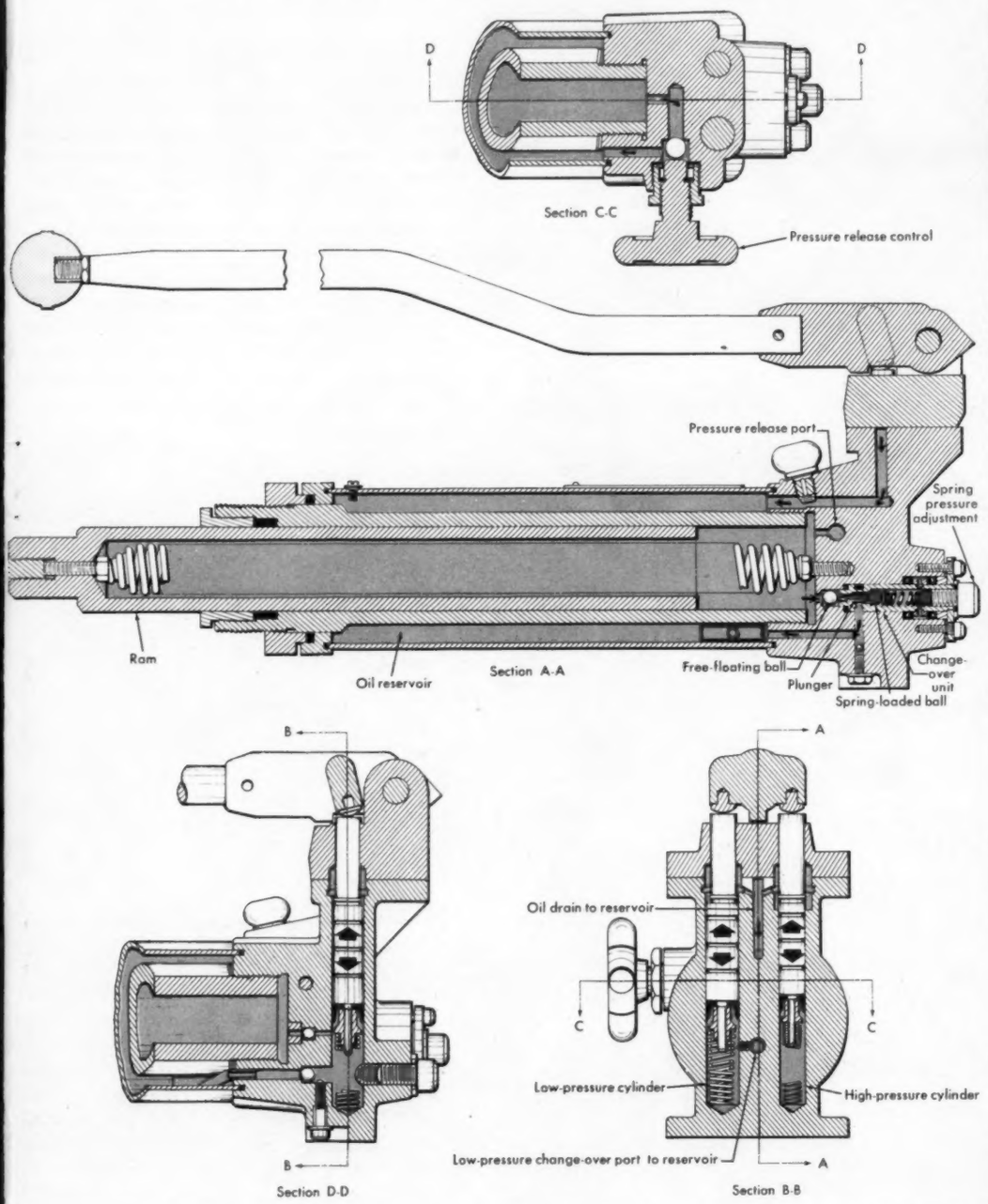
A spring-loaded ball-valve in the manual pump of a pipe-bending machine provides simple automatic two-stage action of the work ram. This change-over device permits making rapid contact between ram and workpiece by using a low-pressure system, which cuts out at predetermined pressure to continue work with a high-pressure system.

The ram cylinder is fed by both high- and low-pressure pump pistons. These draw oil from the reservoir and pump it into the ram cylinder until the required pressure is built up. A low-pressure drain to the reservoir is controlled by the spring-loaded ball valve of the change-over unit. Spring pressure is adjusted by a screw-threaded plug.

At preset pressure, a plunger exposed to ram cylinder pressure is forced forward in its housing. This movement overcomes spring pressure and lifts the ball off its seat, draining the low-pressure pump into the reservoir. The high-pressure pump is then the only one supplying oil to the ram. When pressure in the ram cylinder drops or is released by the hand control, the ball-valve returns to its normal position under spring pressure. Oil flow to the reservoir is then stopped and both systems combine to move the ram quickly up to its working position.

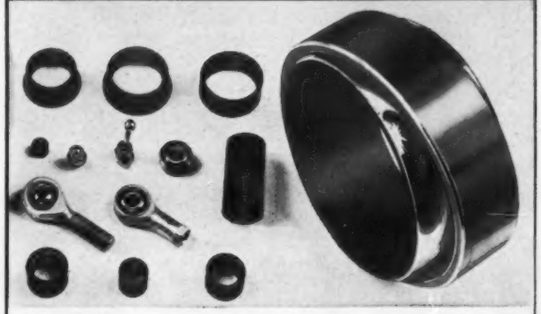
The portable tube bender was designed and patented by Chamberlain Industries, Ltd., London, England.

Valve for Two-Stage Ram Action of Pipe Bender



CHANGE-OVER DEVICE automatically unloads larger piston of pump at 1800 psi so that remaining smaller-diameter piston conveys smaller quantity of oil at increased pressure. Pistons are 25/32 inch dia (area 0.48 sq in) and ⅝ inch dia (area 0.31 sq in) having a combined low-pressure delivery area of 0.79 sq in.

FABROID Self-Lubricating **BEARINGS**



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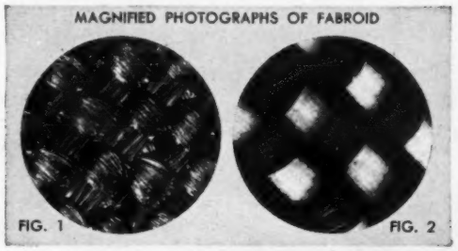

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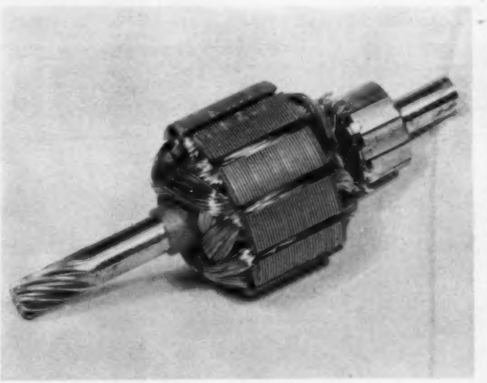
Armature Winder

Lars G. Soderholm, Midwest Editor

A completely hydraulic armature lap winder, after winding the required number of turns in the armature slot, automatically runs through a sequence in which the wire is hooked over the correct commutator tang. This is accomplished through a wire guide that deflects the wire as the driveshaft turns slowly in order to catch the wire on the projecting commutator tang.

The armature winder is driven by a hydraulic motor powered by a variable-displacement pump for good control characteristics over a wide speed range. The machine has a top winding speed of 3000 turns per minute. It requires six turns to accelerate to 3000 rpm. Total time for winding the commutator hooking is approximately 2½ sec per slot.



There are only three actuating motions of the machine: (1) hydraulic motor gives high-forward, forward-medium, forward-low, stop, neutral and reverse; (2) hydraulic index of tooling, and (3) jaw clutch engagement and disengagement.

With separate tooling for each stack length, armature being wound and various diameters and configurations, tooling change-over can be very rapid. Number of turns can be set on counter while a ratchet wheel determines number of slots to be wound.

The automatic armature winder with automatic commutator lug hook-up is a development of the Possis Machine Corp., Minneapolis, Minn.

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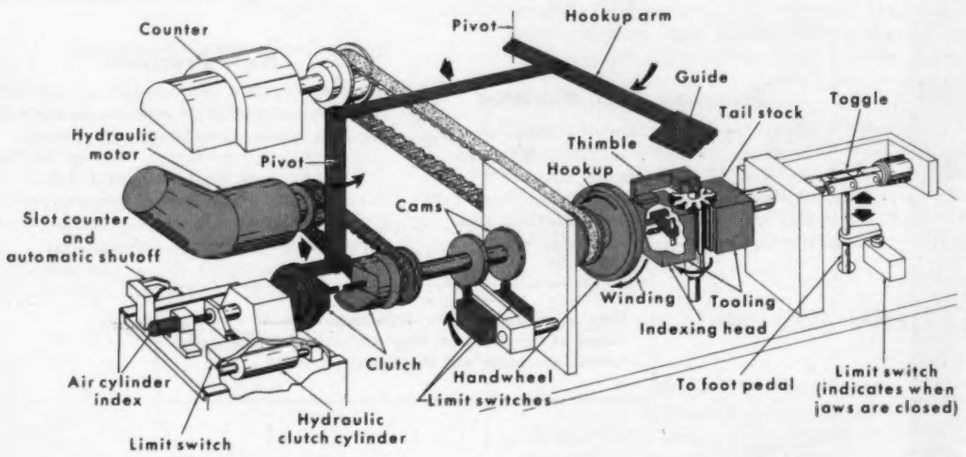
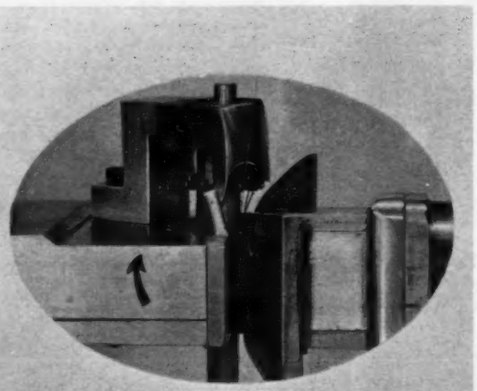
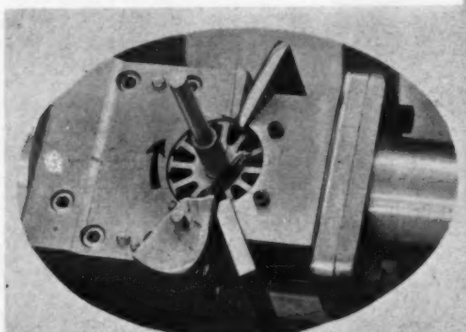
Has Automatic Commutator Lug Hook-Up



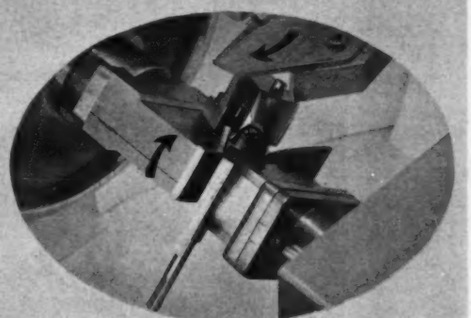
WIRE IS FED from stationary spool, looped around tooling and attached to thimble. One-half of tooling is on driveshaft; other half is attached to foot-operated live-center tailstock. After half turn by hand, automatic cycle button is pressed. Machine then goes into high-speed winding of first coil. Near end of wind, counter signals for deceleration of hydraulic motor. During last turn, mechanism shifts into low speed and two limit switches are raised so cams on driveshaft can strike them. When driveshaft comes around to position where end of armature shaft opposite commutator is "up", one cam hits limit switch, hydraulically braking shaft, and armature is indexed one slot. Drive is then reversed ¾ revolution. Second limit switch is hit and shaft braked. Clutch jaw moves in, giving orientation to driveshaft while wire guide on hook-up arm moves to bring wire across commutator tang. When clutch is engaged, motor turns driveshaft slowly to wrap wire around tang. After 60-deg rotation, clutch disengages and mechanism goes into high forward wind. Each armature slot is wound in same manner until last slot after which counter stops machine.



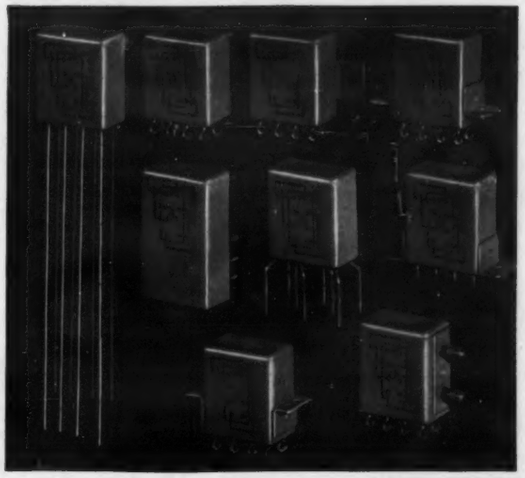
(a) INDEXING



(b) REVERSED 3/4 REVOLUTION



(c) SLOW TURN TO WRAP WIRE AROUND TANG



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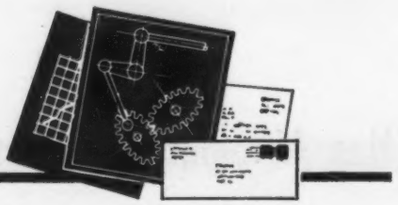
DESIGN NEWS



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Scouring Pad Machine

We have been requested by a customer to obtain the design of a machine to manufacture stainless-steel scouring pads. Can you direct us to a possible source of supply of this design? Write C-50, Idea Mart, DESIGN NEWS, Englewood, Colo.

New Products

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We would be interested in receiving information on any new electromechanical devices, or controls, which would complement our present line of products. Write C-47, Idea Mart, DESIGN NEWS, Englewood, Colo.

Ideas described in this department are in varying stages of development. They are somewhere between initial conception and the prototype stage.

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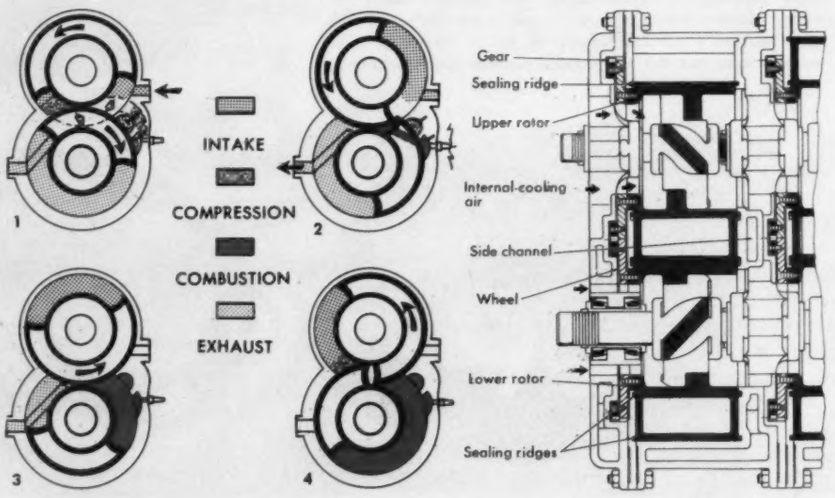
This rotary engine is designed to provide higher horsepower per weight than conventional internal-combustion engines. Among other features, the engine has no reciprocating parts, no dead centers and no side thrust. Rotors move continuously in one direction; full right-angle torque is produced on the drive shaft in any position of the rotors, and internal as well as external cooling is provided.

Briefly, cycle of operation is as follows: compressed combustion mixture is ignited in small chamber at right of center of motor. Ignition moves through side channel to space between lower rotor and outside circumference of upper rotor. Lower power rotor is driven clockwise, and as tip of rotor uncovers larger combustion chamber, burning of this mixture takes place.

At same time, a fresh charge of combustible gas is drawn into upper rotor space from conventional carburetor or fuel-injector system. Fresh charge is compressed as lower rotor enters open space of upper rotor, forcing charge through triangular-shaped port in upper rotor case and through side channel and check valves into combustion chambers. Valves do not open until exhaust port at left of motor opens, causing pressure from previous cycle in lower rotor space to drop and compressed gases back of



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Punched-Tape Perforator

We have developed a punched-tape perforator of simple design for low-cost manufacture. Our present prototype is conservatively reliable at 20 per sec operation. It has been designed for eight-channel punching of 1-, ⅞- and ¾-inch tape and is synchronous.

At the present time we would welcome risk capital for further development and/or hope to contract to supply quantities of this perforator to OEM organizations for incorporation with their automation systems or equipment. Write C-48, Idea Mart, DESIGN NEWS, Englewood, Colo.

check valve to enter combustion chambers. Chambers have been sealed by lower rotor position in that portion of exhaust cycle.

During time taken for completion of intake and compression cycles, exhaust cycle also is taking place and new combustion cycle is beginning before previous exhaust cycle is completed. One revolution completes all four cycle operations.

Several features provide adequate sealing, an inherent difficulty with this type of design. Circumferential sealing ridges on edges of rotors operate in grooves cut in the rotor case. This provides tight seal at outside and inside circumferences of rotors, especially at rotor crossovers. Floating snap rings are optional.

Radial spring-operated seals at sides of rotors function in manner similar to rings on a piston in a cylinder.

Spring-actuated bars are used to seal the tips of the rotors against each other and against inside circumference of rotor cases.

Pressure-operated transverse seals tighten crossover points at outer circumference of rotors.

In addition to external cooling, a 45-deg angle on the spokes between the hubs and the inside of the rotor chambers causes internal circulation of air.

A preferred design of this engine uses a flange valve in place of the poppet valves.

A patent on this invention is pending. Write C.E.M., Idea Mart, DESIGN NEWS, Englewood, Colo.

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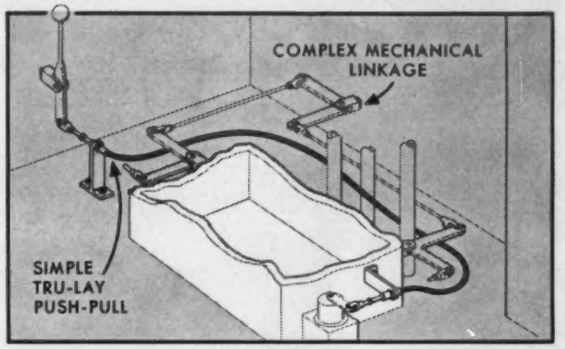

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3/16"	5	115-175
1/4"	6	300-600
5/16"	8	700-1,000

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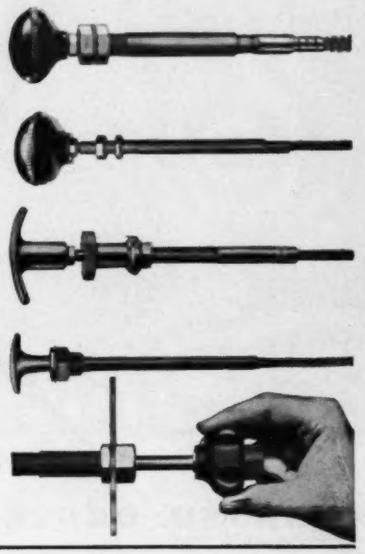

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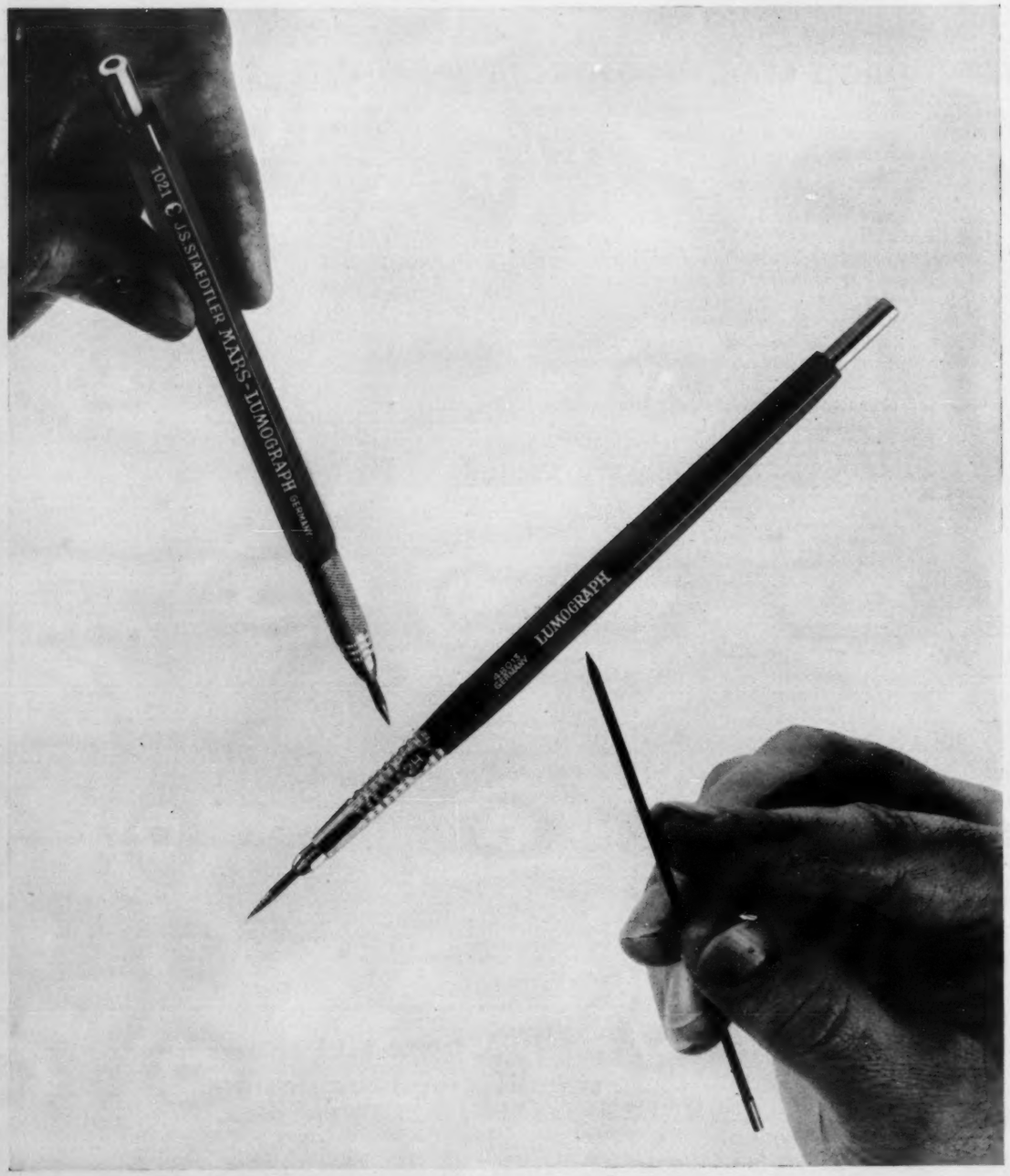

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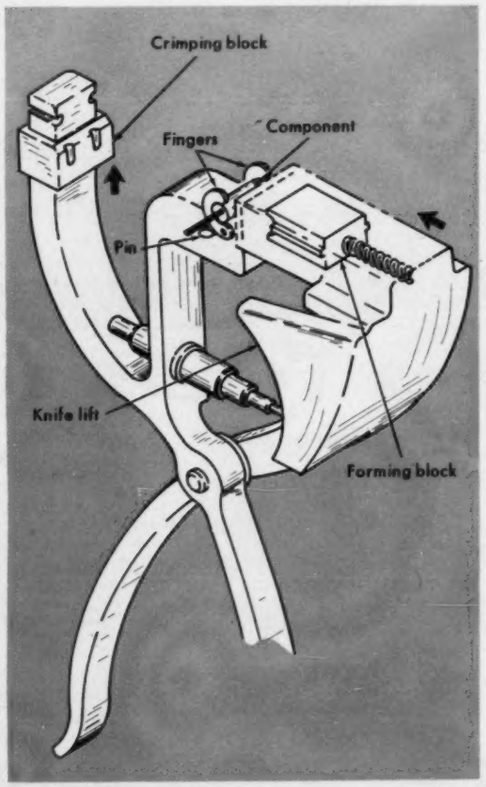
Axial Lead Forming, Inserting, Cutting and Crimping Tool

The purpose of this invention is to provide a single hand tool that will form the leads of an axial lead component such as a resistor, diode or capacitor. It will insert the component into a printed-circuit board, cut the leads to a predetermined length and crimp the ends.

The tool is used by placing the component in the fingers and compressing the handles. This action causes the spring-loaded forming block to hold the body of the component. As the housing moves forward, the leads are formed and forced through predrilled holes in the circuit

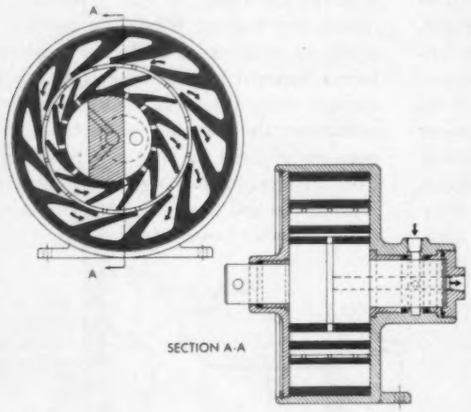


board and into slots. The fingers are moved down when spring-loaded pins are depressed by slotted knock-offs. The knife lifts raise the knife-edge crimping block, cutting the leads to size. The crimp block continues upward as the handles are compressed, allowing the component lead to be crimped in slots. When pressure on the handles is released, the tool returns to its retracted position by the action of the compression spring and is ready to accept the next component. Write D.A.D., Idea Mart, DESIGN NEWS, Englewood, Colo.

AVAILABLE

Fluid Pump With Flexible Vane Rotor

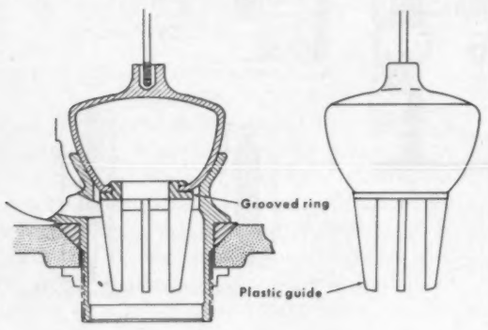
Purpose: To increase the displacement and reduce the wearing surfaces of a rotary pump. Principle also applicable to motors or turbines. Design: Outer vaned structure is bonded to housing around its periphery, and inner rotor vaned structure is bonded to circular offset of shaft. Between the series of dual vanes, whose tips tend to meet, is a ring which acts as a separator to keep fluid from passing other than radially via holes or side notches. This ring should have a low coefficient of friction, hence, it may be of glass, plastic or metal. The slots take all flow from holes inside inner vaned structure, which is bonded to this circular offset, with slots and holes free to pass all fluid. Ring may turn slightly, yet is free to "float". Write W. E. G., Idea Mart, DESIGN NEWS, Englewood, Colo.



Ball Flush Valve

As shown in the drawing, four plastic prongs form a guide which does away with the standard guide that is clamped to the overflow tube and the extra wire that so often tangles with the clamped-on guide. The four-guide piece is joined to a grooved ring which can be buttoned into a standard ball flush valve. The guides also will clear the nut which is often used in assembling the flush tank to the bowl.

A manufacturer is desired for this item. Write J.O.M., Idea Mart, DESIGN NEWS, Englewood, Colo.



Reuland motor-and-magnetic-brake package

...complete from one dependable source!

Reuland manufactures its own magnetic brakes, as well as electric motors, and offers the most versatile selection of tailored-to-your-equipment *brakemotor* packages available anywhere. Reuland's many hundreds of combinations of H.P., speed, special drive motors and brake sizes, provide an almost unlimited coverage of O.E.M. and user requirements!

So, whatever your *brakemotor* needs may be, standard or special, let Reuland supply the complete answer in one, compact, smartly-designed power package. One source of supply for brake and motor saves time for your Engineering and Purchasing Departments... one nameplate establishes dependable, nationwide service responsibility!

BRAKES AVAILABLE IN ALL 3 MOUNTINGS... FULFILLS J.I.C. SPECIFICATIONS!

1. Direct endbell type for mounting over motor's shaft.
2. Foot mounted, for mounting over existing shaft.
3. Foot mounted — complete with own bearings and shaft.

- Automatic Lining Wear Adjustment
- Manual Release— Automatic Reset
- Mount in any position
- No Levers or Linkage
- One-Piece Housing
- One-Half Conventional Length
- Wide Range of Ratings

Refer to Sweet's Product Design, Section 5-a

Our new 8-page catalog, No. GS8-30-0, will come in handy. Sent complete with prices and engineering drawings on request.

MODERN POWER FOR MODERN-DAY PRODUCTS

... all in lightweight, cool-running aluminum frames!

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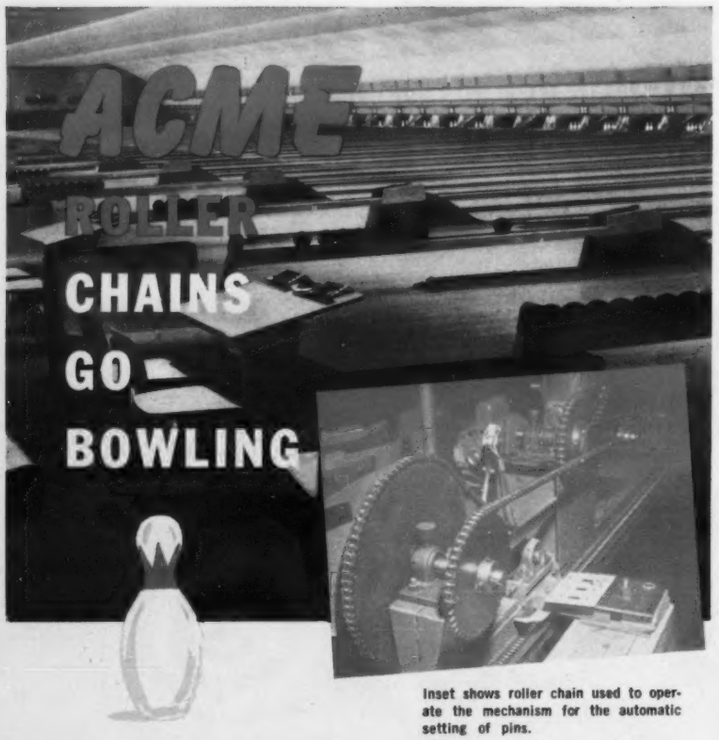

Inset shows roller chain used to operate the mechanism for the automatic setting of pins.

Bowl-Mor, pioneers in bowling automation, utilize Acme chains in the building of its pinsetters. Bowl-Mor not only manufactures this equipment, but services it to the entire industry. Its volume and fame has spread throughout the United States and Canada.

Acme Roller Chains were selected because, in addition to accurate timing they deliver over 98% of the power furnished by the driving sprocket, for the efficient operations of their pinsetting machinery. Acme chains reduce costly production and maintenance time and are easily installed.

Be sure to get more for your chain dollar by specifying Acme Chains. They are available in all sizes from ¼" pitch to 2½" pitch.

Call your local Industrial Distributor. He carries a complete line of Acme Roller Chains and has the full cooperation of Acme's Engineering Department.

Acme Chain Corporation
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Write Dept. 14-X for new ill. 100 page catalog with engineering section.

RELIABLE CHAIN DRIVES FOR ALL INDUSTRIES

ROLLER CHAINS, SPROCKETS, CONVEYOR CHAINS, FLEXIBLE COUPLINGS, ATTACHMENTS. (Special and Standard)

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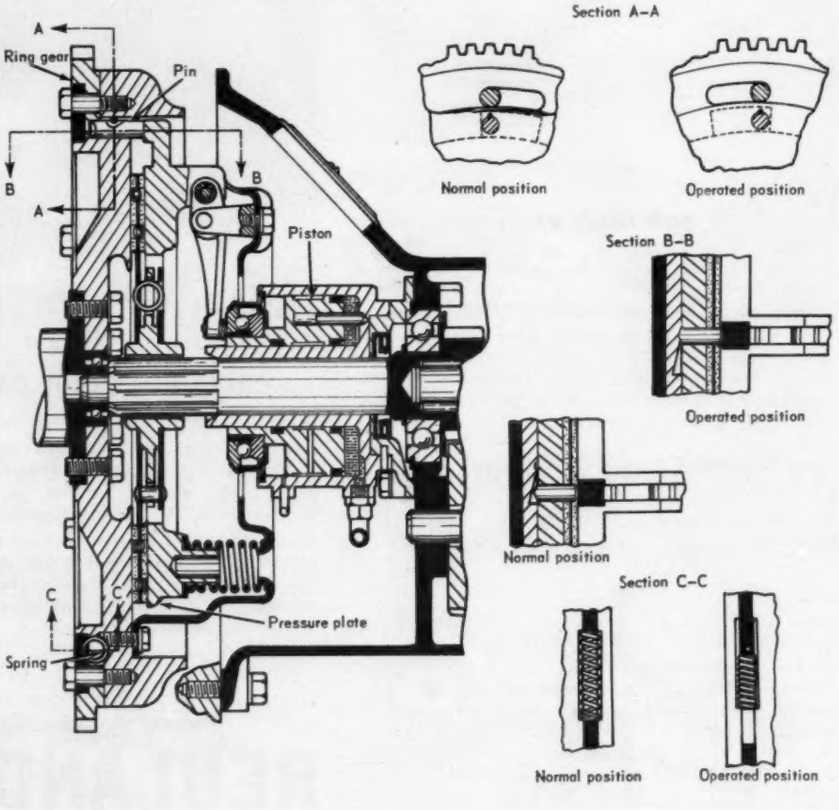
Auxiliary Disengaging Mechanism for Automotive Clutch

U. S. Patent 2,969,052; Glenn T. Randol, Mountain Lake Park, Md.

This patented mechanism is designed to control a manually or power-shifted change-gear transmission without a clutch pedal. The unit incorporates an engine starter-actuated disengager which permits restarting of a stalled engine even though the clutch may be torque loaded due to movement of the vehicle while in gear.

Fig. 1 shows the clutch engaged, the engine stopped and the transmission in high gear. When the starter switch is pushed and the starting motor engaged, pins on the flywheel are thrust into engagement with the pressure plate, thereby opening the clutch members and releasing the engine so the starting motor can crank it. When the engine starts, hydraulic pressure is initiated by a pump, which in turn is directed by a rotary valve to a hydraulic actuation chamber, causing a piston to move forward. The clutch pressure plate is additionally withdrawn to restore normal control of the clutch to the hydraulic actuator. As a consequence of the energization of the actuator, thrust impressed on the pins by the relatively rotated ring gear is relieved.

The ring gear is free to return automatically under influence of springs to a reset position. The ring-gear disengagement of the clutch is only sufficient to relieve the engine. When the hydraulic actuator becomes operative, the piston moves forward to actuate release levers through their full operating stroke, which withdraws the pressure plate beyond a position affected by ring-gear actuation. Pins are freed of locking action between impressions and tapered ends, permitting them to move out of depressions.

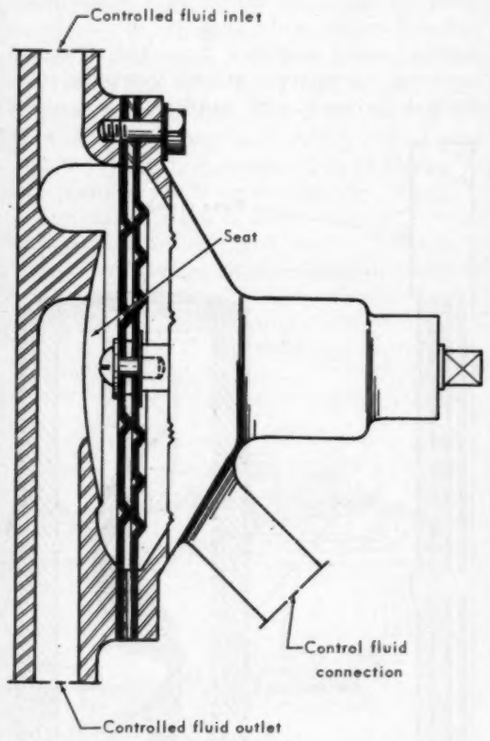


Fluid Control Valve

British Patent 842,160; Stanley H. Edge, 297 Warwick Rd., Olton, Solihull, Warwickshire, England.

This patent describes a valve in which flow is regulated by varying pressure of controlling fluid upon a diaphragm consisting of two flexible-material layers. Layers have corrugations to preserve a space between them and to insure that they flex in unison. The space is bled to atmosphere through radial grooves in a flat rigid ring located between the layer peripheral rims.

Should either diaphragm layer fracture, the fluid contacting it passes into the space and ex-



capes through the bleed grooves. The design prevents the two fluids from mixing should failure occur, gives warning that failure has occurred and permits identification whether controlled or controlling fluid is escaping. Initial diaphragm setting is by a tension spring secured between a fitting in the diaphragm-assembly center and an adjustable stem in the domed-cover boss.

All 5 MIL Tantalum Foil Capacitor Sizes From OHMITE

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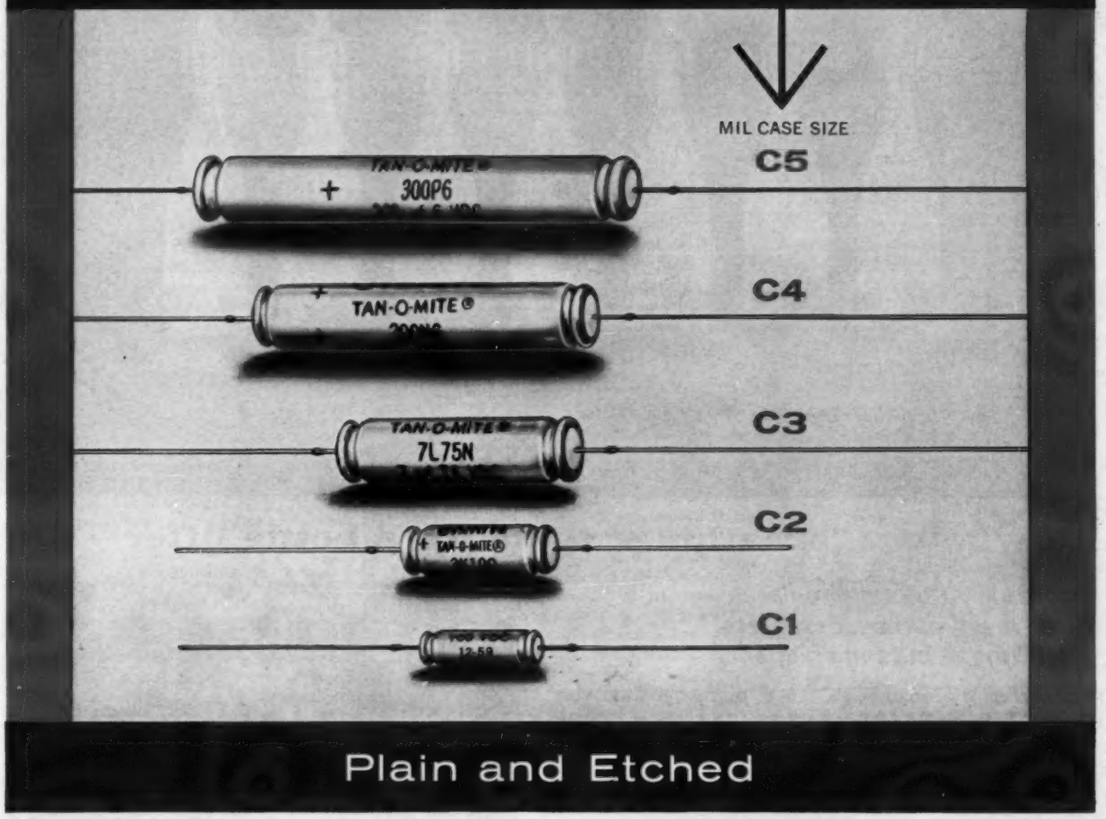

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Whether you need *immediate delivery* from stock on prototypes, or production quantities of tantalum foil capacitors, Ohmite can handle your requirements.

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Write for Specification Bulletin 152G which lists 200 stock values, including all MIL values, and shows a *handy scale for conversion* between "equivalent series resistance," "power factor," and "dissipation factor."

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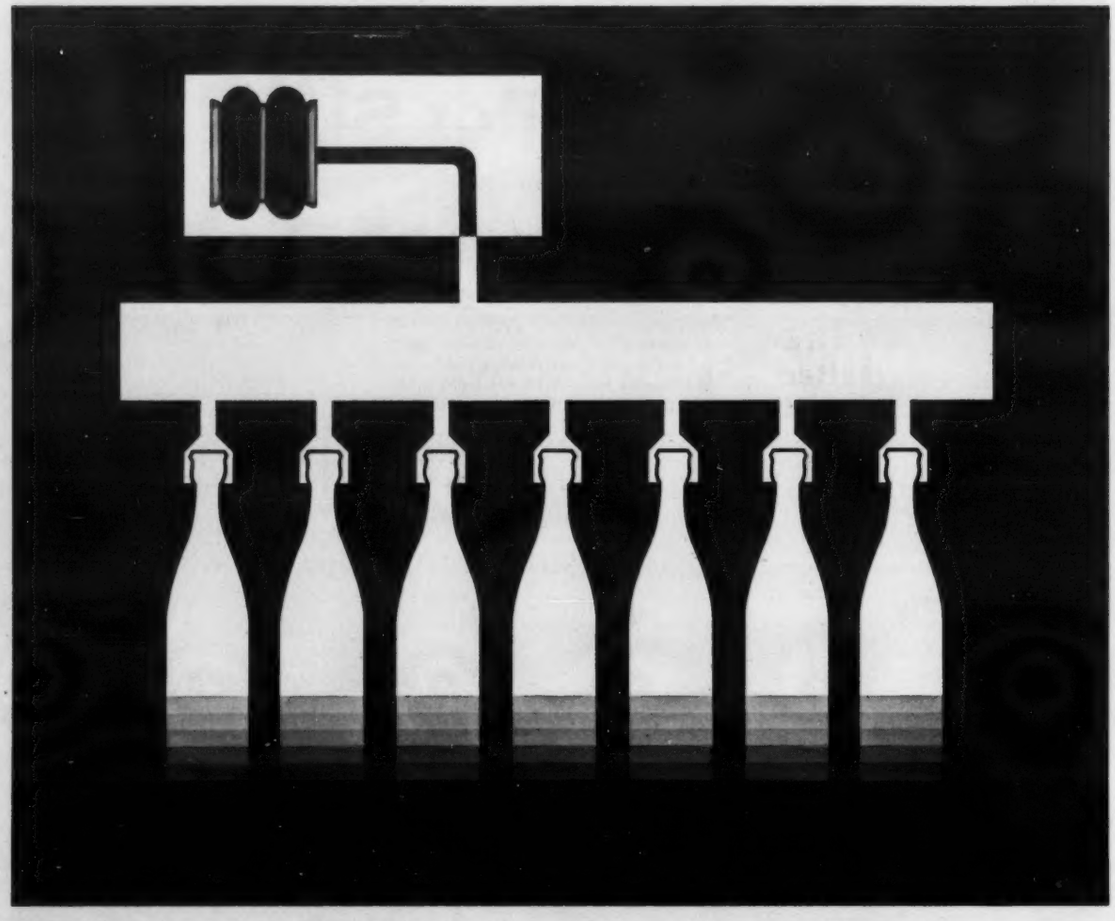
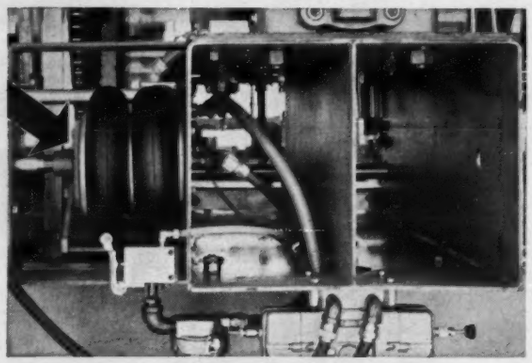


How to cut "breathing" costs for a bottle lifter

Firestone Airmount® replaces three metal pumps, costs less, lasts longer, cuts maintenance

Until recently, chambered metal pumps created the differential pressures required to set the grip of rubber pick-up cups used in Lodge and Shipley pneumatic bottle lifters. Then their engineers replaced the complex pumps with low-cost Firestone Airmounts—creative thinking that paid off: Firestone Airmounts require virtually no maintenance, last much longer and initial cost is substantially less. And, in some applications, one Airmount did the work of *three* of the expensive pumps. This is only one of many ways Firestone Airmounts meet industry problems with low-cost, long-term solutions. Write Dept. 42-2 today, without obligation, for details on how they can serve *you*.



Firestone Airmount is stroked to pump air into inflatable pick-up cups to grip and lift bottles. Simplified design saves Lodge and Shipley money, allows more compact system designs, too.

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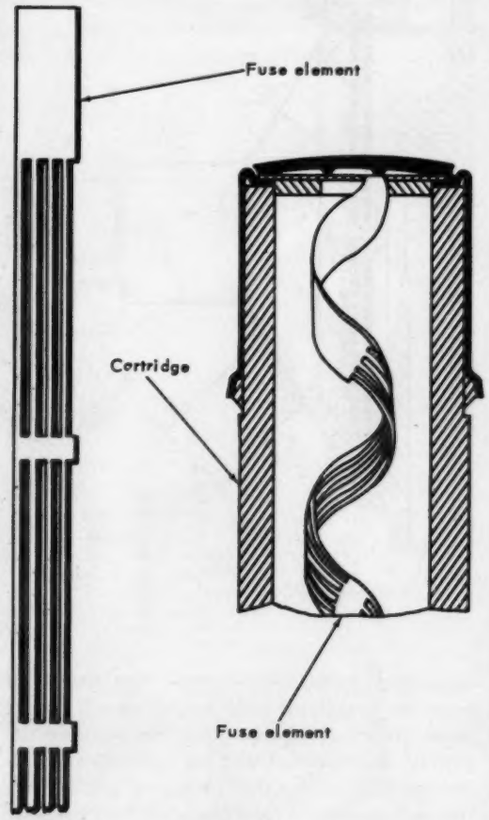
PATENTS

High-Capacity Cartridge Fuse

British Patent 813,643; William James Elliott, General Electric Co., Magnet House, Kingsway, London W.C. 2, England.

Parallel fuse sections, arranged in series to suit requirements, are provided in a new fuse element by cutting longitudinal slots in a silver strip. Slots are made by cutting out metal on three sides, leaving rectangular portions which are bent at right angles to form projections. These add rigidity and permit shaping into a coreless helix for mounting in the case. In addition, the sections are sufficiently rigid to preserve their correct relative positions during and after filling of the case with sand or other arc-quenching material. A transverse tie is left between each section series.

Cutoff occurs at the edge line of the ties, as current density is greatest there. The element is mounted in a refractory or other insulating, tubular body having metallic end ferrules as contacts.



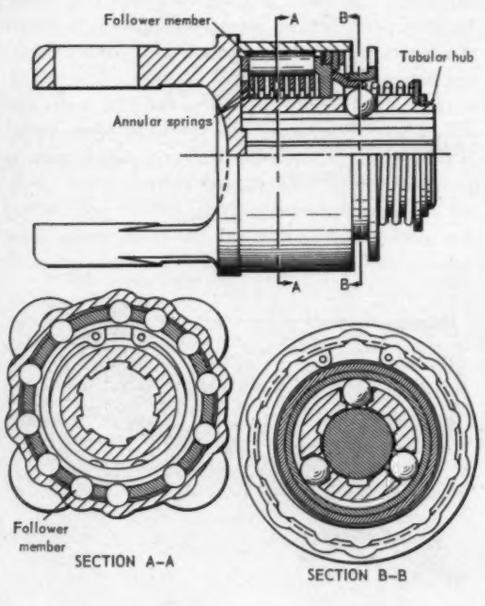
Overload Clutch

U. S. Patent 2,960,852; Kurt Schroter and Bernhard Walterscheid-Muller, Lohmar, Germany.

This overload clutch may be used between universal joints. Part of the clutch consists of a tubular hub mounted on a shaft. A cup-shaped holding member is provided with slots in which cylinder-shaped follower members are arranged. These members are pressed into recesses by annular springs.

The annular springs have a cutaway section. The springs have their largest cross-section opposite opened ends and their tapers are in a direction toward cutaway sections. The springs are freely rotatable and have a comparatively small width. It is possible to adjust desired torque limit by using a different number of springs.

The clutch is provided with at least two tangentially spaced follower members resiliently supported on one part of the clutch and engaged in recesses on the other part. The members are so spaced and arranged relative to each other that the full locking effect is obtained in two switch positions only, each of which is obtained after a turn of 180 deg. After an overload has occurred and the clutch has disengaged, it re-engages in two positions which are displaced by 180 deg. It is only in these two positions that all follower members are in operation and full torque is transmitted. During all other possible engaging positions, some of the follower members are disengaged so that only a small torque is transmitted. The clutch automatically adjusts the joints to assume the correct position.



HOKE Flow Sheet 4

HOKE REPORTS ON FLUID CONTROL

HOW TO SWITCH PRESSURES IN MID-STREAM

PRESSURE BY THE POUND . . . no matter how thin you slice it!

One trouble with doing something better is that it's hard to stop. This time, we've come up with a new line of pressure regulators. We made them for the technically oriented who have developed high standards and for the penurious purchaser who wants something for (almost) nothing.

One, tagged as the 680 Series, is a highly stable single stage regulator with something for just about everyone. The core of this regulator is its control accuracy of 2% at flows to 2000 SCFH. Two models are available. One delivers 0 to 40 psi and the other 0 to 140 psi and both can handle inlet pressures up to 3000 psi. Use them on any gas compatible with 2024-T4 aluminum alloy, neoprene, polyurethane and Buna-N.

If what we've said sounds good so far, but still won't solve your problems, read on.

We've built a regulator specially for corrosive gases and atmospheres. Available in either all monel or all stainless steel construction, we call it the 640 Series. Spec sheets on this can be had by marking an "X" below.

If you "X" the next box, you'll get a package of useful information on a special regulator that will handle delivery pressures up to 4500 psi with very high control accuracy. This is a 2 stage spring and dome loaded regulator and we claim that a 50% change in inlet pressure will not change the delivery pressure more than 2%. Operation is simplicity itself. For no particular reason, we call this the 920 Series.

Skeptics should send for all of this information.

For reasons now hidden by the veil of tradition, no one has ever attempted to scrunch a pressure switch to its proper proportions—that is, until now. With sales getting bigger from making things smaller, we decided that this was the path to profit. Ergo; the new Hoke Pamar pressure switch.

This isn't just a case of arrested development, but something entirely new. The scrunching process necessitated less parts, so conventional connecting linkages were the first to go. The direct result: a switch with only one moving part—nothing to wear and upset the actuation setting.

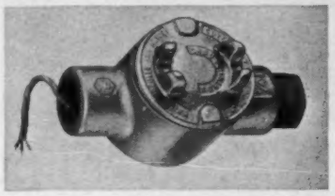
The ordinary bellows was out of the question, so we used a Ni Span C capsular type sensing element. Out of this came such things as high repeatability, minimum hysteresis and drift, maximum temperature stability, and a dead-band of minor significance.

The whole assembly measures less than 2 inches from tip to terminals, and weighs short of one ounce. Despite these diminutive dimensions, it is capable of handling working pressures to 500 psi with a repeatable accuracy of ±0.5%. Electrically, it sports a snap-action switch that will conduct a current of up to 7 amps to a variety of connectors – AN, cabled leads, solder terminals, or whatever you want. Interested in pressure switches for explosive atmospheres? Specify the explosion-proof model.

A special low pressure switch (0 to 7 psi) defies competition with a dead band of 2" of water!

If what you're looking for in a pressure switch seems impossible to find (even with the wonders we've described here), we'd like to hear about it. We thrive on doing what others shrink from, and will build a switch to your specs. Write and tell us your problem.

We could go on, but that wouldn't leave us with the usual advertising "hooker". We want to hear from you. In return, we'll send you the rest of the story.



WHAT'S NEW FROM HOKE?

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Hoke's Performance Guarantee—*Every Valve Leak-Tested!*

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Send me complete information on the Hoke products checked below:

- ☐ Pamar Pressure Switches
- ☐ 680 Series Regulator
- ☐ 640 Series Regulator
- ☐ 920 Series Regulator
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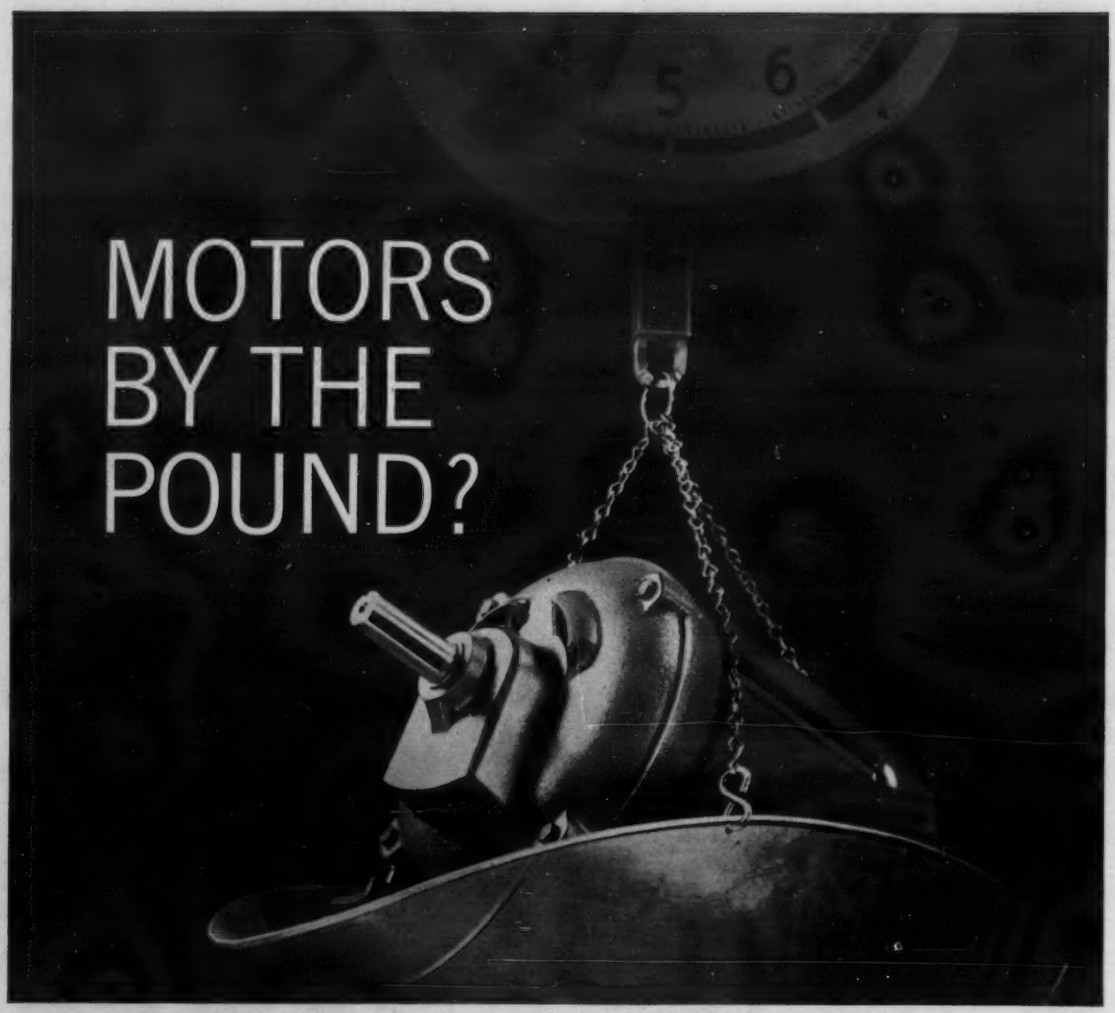

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Wagner® protected polyphase motors do cut expensive downtime. Their cast iron frames can't be affected by corrosive acids, salts, or alkalies. They are designed for cool running . . . stator temperatures stay low to increase motor life. Wagner polyphase motors are designed to permit relubrication that adds years to motor life under severe operating conditions. Wagner motors have earned a reputation for proven dependability.

Next time you buy motors, check beyond the purchase price. Make sure that you get all the performance you need—with motors that will do the job.

Wagner motors have been getting the job done for more than 65 years. Your Wagner Sales Engineer will be glad to show you why. Call him for an analysis of your next motor application, be it for plant or product.

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PATENTS

Hydraulic Master Cylinder

British Patent 808,280; Harold Hodkinson, Dunlop Rubber Co., Ltd., 1 Albany St., London, N.W.1., England.

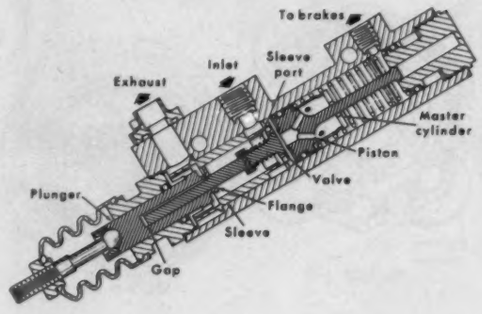
Two-step fluid flow control through a master cylinder provides for brake application if the engine-driven pump should fail.

Under normal conditions, fluid is pumped into the cylinder approximately at its midpoint. Passages through the main piston permit pressure developed to act on the wheel cylinders, fed through a line connected behind the main piston. Because exhaust flow through the other end of the cylinder is relatively unrestricted, pressure is very small and does not actuate wheel cylinders.

Brake pedal movement pushes a plunger with a fluted and punctured flange at its face into the sleeve through which fluid passes from the inlet to the exhaust port. Flow is increasingly restricted and finally cut off. Correspondingly, pressure at the wheel cylinders rises until full pump pressure is applied.

With engine stopped or pump inoperative, there is no flow for the plunger to obstruct. Brake pedal movement displaces the plunger until a valve rod axially and loosely fitted into it bottoms in its bore. Gap dimension at the bore end is critical and is slightly greater than plunger displacement necessary to fully close sleeve. The valve rod is then also moved until its end closes the central opening in the main piston. Plunger, valve rod and main piston move together, using fluid trapped behind piston to apply pressure to the wheel cylinders in more or less conventional not-power-assisted manner.

Helical springs behind valve rod and main piston restore these to normal positions when pedal is released. Guidance for the main piston stem is provided by a bore in the cylinder end plug, which simultaneously acts as a dash pot. When not mechanically displaced, the main piston seals against the inner sleeve end.

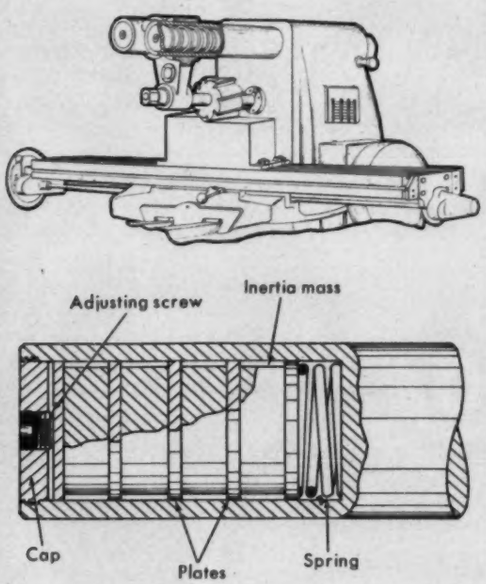


Vibration Dampener

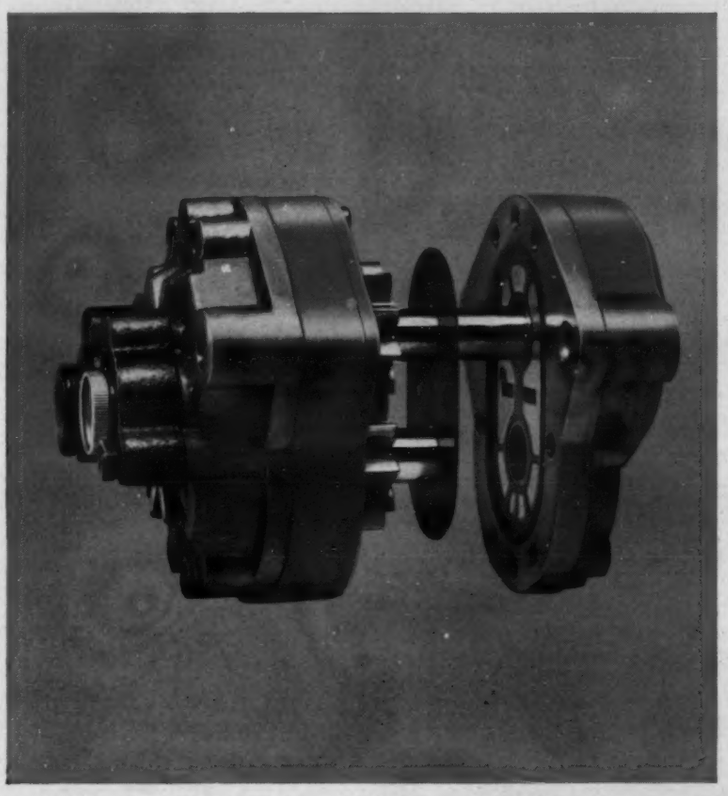
U. S. Patent 2,960,189; John G. Osburn, assignor to Kearney & Trecker Corp., West Allis, Wis.

This vibration dampener mechanism is designed particularly for machine tool members which operate at high speeds and feeds and are susceptible to vibration. The unit consists of several inertia masses interspersed between friction plates. The masses and plates are housed in an opening of the member to be stabilized and resiliently urged into a predetermined degree of frictional engagement. Friction created by relative movements between inertia masses and plates dissipates the energy in the form of heat. The illustration shows the device incorporated into the overarms of a horizontal-type milling machine.

The compression device may take the form of a spring. Each circular friction plate has a diameter which produces a snug fit within the bore. Outer face of each plate is provided with a friction surface. Inertia masses are of slightly smaller diameter and are placed to bear on the friction faces of the plates. The inertia masses are provided with friction surfaces similar to the plates. A closure cap is provided with an external thread to engage the end of the bore and to retain the elements against the spring. A screw is provided in the closure cap to permit adjustment and various degrees of frictional pressure between masses and plates.

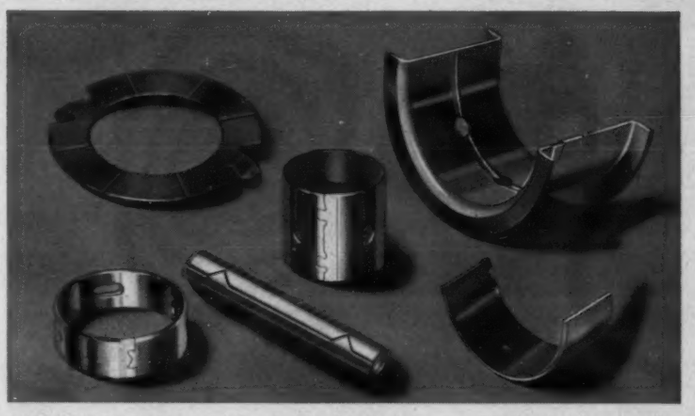


F-M WEAR PLATE "RIDES HERD" ON TURBULENT PRESSURE



IN CESSNA'S NEW HYDRAULIC PUMP LINE, F-M WEAR PLATE DIAPHRAGMS KEEP FLUIDS IN LINE to deliver pressures up to 2000 psi for aircraft, farm and construction equipment, many other hydraulic applications. These wear plate diaphragms maintain positive contact with gears to assure high, uniform pressure. To provide a bearing surface for this job, Federal-Mogul applies a high-density bronze to steel by a special sintering process. F-M high-density bronze prevents fluid absorption, and it affords good lubricity, needed because some hydraulic fluids are poor lubricants. To further prevent the escape of hydraulic fluid, these F-M diaphragms are manufactured for a snug, close-tolerance fit in the pump housing.

THE COMPLETE LINE of products from Federal-Mogul Division includes sleeve bearings, bushings, spacers, thrust washers, as well as wear plates. Through the years, F-M has amassed a wealth of knowledge and experience . . . from constant research, from solving bearing design problems for all kinds of products. Our engineers are ready to put this know-how to work and tailor bearing products to your requirements . . . with top performance assured.



A DESIGN GUIDE provides valuable engineering data for designers on F-M thrust washers as well as wear plates. Also available is literature on sleeve bearings, bushings and spacers. For your copies, write Federal-Mogul Division, Federal-Mogul-Bower Bearings, Inc., 11055 Shoemaker, Detroit 13, Michigan.

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sleeve bearings
bushings · spacers
thrust washers

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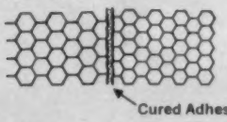
#9 JOINTS IN HONEYCOMB CORE

In the design of sandwich structures, the problem of joints in honeycomb core materials is frequently misunderstood or overlooked. Effective joints are easy to make. They are extremely useful in assembling panels using more than one type or density of core material and in the manufacture of parts larger than those possible with conveniently available core sizes. Most important of all, many common types of joints in honeycomb core are both inexpensive and efficient.

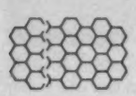
Fig. 1—Adhesive Splice



Splice Line Not Related to Cell Orientation

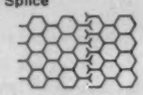
The most frequently used joint is the butt adhesive joint (Fig. 1). The shear load in the honeycomb core of this joint is transmitted from the cells on one side of the joint through the adhesive material into the nearest cells on the opposite side of the joint. Sprayed adhesives, roller-coated adhesives, or a foaming tape make these joints extremely reliable.

Fig. 2—Y-Butt Splice



Adhesive or Wet Resin Applied to Dog-Ears

Fig. 3—Y-Interlock Splice

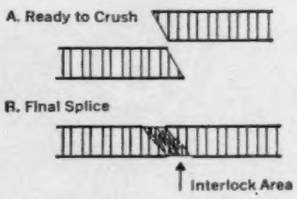


Exact Orientation of Splice Line to Cell Structure

Where electrical performance is important, as in radome applications, a high-strength, nearly perfect joint can be obtained with a Y-butt splice or a Y-interlock splice (Figs. 2 and 3). These joints are somewhat more costly to make than the butt adhesive joint, since they call for careful matching of the cell configuration to maintain the honeycomb pattern throughout the splice. These joints will develop nearly full core shear strength without any applied adhesive and more than full shear strength with only a slight amount of liquid resin adhesive applied to the joint.

The most economical of the commonly used structural joints in honeycomb core material is the crush-splice. To manufacture this joint, one piece of honeycomb is overlapped approximately two cells over a second piece of honeycomb, and the two pieces are crushed together. In some types of fiberglass honeycomb, this joint will develop full core shear strength. In aluminum honeycomb, a small amount of adhesive must be placed in the crushed area in order to develop full shear strength of the core. For thick slices of honeycomb, it is advisable to bevel the edges of the honeycomb in order to achieve a satisfactory interlock without destroying the core to the extent that good shear performance is lost. 30°, 45° or 60° bevels are all effective, but the greater angles are recommended for thicker core slices (Fig. 4).

Fig. 4—Beveled Crush Splice



All of the joints described may be used to join different densities of core together or may be used to join totally different core materials together. The plan layout of the joint can also be widely varied. Many honeycomb fabricators now readily perform once-difficult joining operations such as a butt joint with foam tape, in which three different ribbon orientations and two core densities are joined to make a single part.

See the Hexcel Brochure, **This Is Hexcel Honeycomb,** in Sweet's Product Design Catalog file.

Further information on honeycomb core is available from Hexcel Products Inc. Write Dept. D-4.

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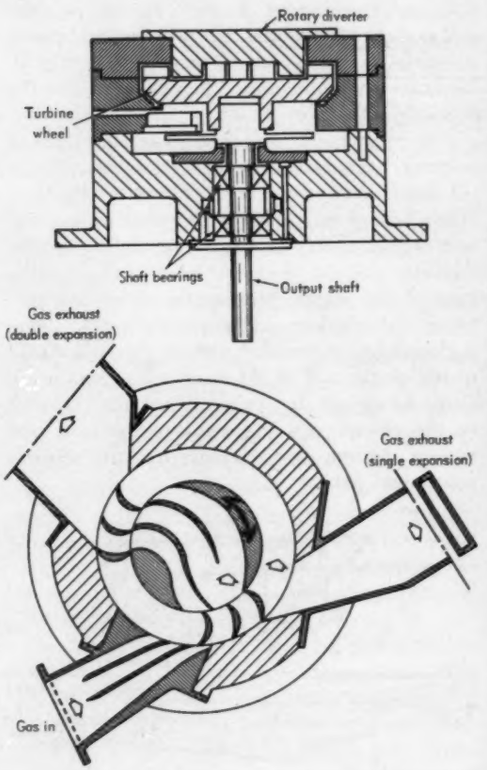
PATENTS

Turbine

French Patent 1,231,795; Gerald Govert, assigned to Commissariat a l'Energie Atomique, Paris, France.

This patent describes a very high-speed turbine in which speed regulation between maximum and minimum values, while very precise and sensitive, is made by very simple means. A rotary diverter within the turbine wheel turns through 90 deg to regulate the speed.



Gas input volume is constant, contrary to usual designs. To provide maximum power output (maximum speed at constant torque), part of the gas flows through the diverter after a first expansion through the turbine. This diverted gas is then redirected against the turbine wheel, through which it expands again. In the position shown in the illustration, tapping of gas is maximum, so speed is maximum. If the diverter is rotated 90 deg, no gas is tapped off and speed is at its minimum. The diverter can be operated by any control system.

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Feather Control **OF THE LOAD**

NEW FROM VICKERS

New Vickers Directional Valve Outperforms All Others

Greater capacity, improved metering provides smooth, precise, jerk-free load control never before possible . . . many other benefits, too.

TO manufacturers of materials handling, construction and other hydraulically operated mobile equipment, the new design of the Vickers CM11 valve offers startling opportunities. Truly a customer and market oriented product design, it meets all basic needs of the changing mobile equipment industry today and for the foreseeable future. In some cases it permits equipment progress previously impractical. To highlight a few benefits of the new CM11 design:

2500 psi OPERATING PRESSURE

The new CM11 Series valve offers the highest operating pressure for its size in the industry . . . *2500 psi!* Yes, this greater pressure is practical without increasing over-all dimensions, thus making the new design completely interchangeable with previous Vickers models. Even though more force is available to do more work because higher pressures can be handled, standard high pressure fittings and hoses are currently available to meet system requirements.

NEW LOW PRESSURE DROP

The new Vickers CM11 series design has substantially reduced pressure drop at all rates of flow . . . 25% less drop! As an example, pressure drop of these units at 15 gpm is no greater than on former Vickers designs at 12 gpm . . . even less than that of other designs! (see Fig. 1)

This means more work capacity on every type of equipment with less horsepower wasted in the valve itself. Less heat is generated at the valve and, on electric trucks, valuable battery ampere-hours are conserved to do useful work.

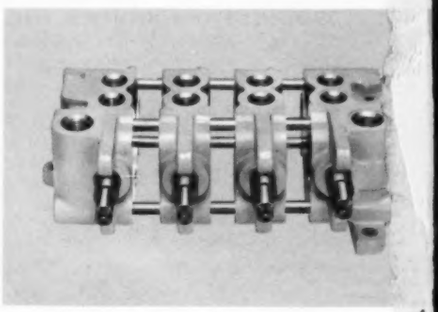
FINEST METERING YET

Due to design changes incorporating a new specially-developed casting, new Vickers CM11 valves feature the finest metering characteristics ever achieved. The result is true feather control of the load at all times . . . the jerky, rough control of all other valves is now a thing of the past.

This improved metering is the result of a number of material and design factors which give smoother spool action under all conditions and much more precise control of oil flow.

FLEXIBLE INSTALLATION

The new CM11 valves are completely



interchangeable with previous Vickers models. And still featuring multiple unit construction (a Vickers first) you can assemble as many control units as you need . . . even add to them later in the field.

NO HIGHER PRICE

All the advanced features above, along with many more not covered here, all are available without any increase in price! Improved manufacturing techniques, new tooling and increased demand give you the greatest value in valves ever offered.

FOR FULL FACTS

To get all the facts, all the features, all the answers to your own valve requirements simply write, or wire collect, to address below. Ask for Bulletin M-5112.

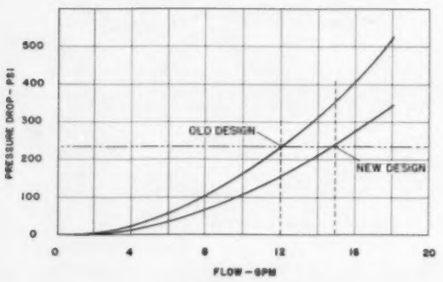


Fig. 1

VICKERS®

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Mobile Hydraulics Division
ADMINISTRATIVE AND ENGINEERING CENTER
DETROIT 32, MICHIGAN, U. S. A.

The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

INFINITELY VARIABLE GEAR
U S Patent 2,973,653; Franz Riedl, Munich 8, Germany.

VARIABLE-PITCH DIAMETER SHEAVE
U S Patent 2,973,656; Paul G. Kurre, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CENTRIFUGALLY OPERATED FLUID-PRESSURE GOVERNOR
U S Patent 2,973,670; Robert O. Dameron, assignor to Ford Motor Co., Dearborn, Mich.

FRICTION DRIVE, POWER TRANSMISSION MECHANISM
U S Patent 2,973,671; Douglas A. Elkins, Salt Lake City, Utah.

SOUND-DAMPENING PUMP
U S Patent 2,973,716; Louis Thomas, assignor to C. H. Wheeler Mfg. Co., Philadelphia, Pa.

BOOSTER PUMP
U S Patent 2,973,717; Robert M. Kendig, assignor to Westinghouse Air Brake Co., Wilmerding, Pa.

CUSHIONING STRUCTURE FOR FLUID-ACTUATED CYLINDER
U S Patent 2,973,744; Ransom J. Hennells, assignor to W. E. Hennells Co., Ann Arbor, Mich.

HYDRAULIC SERVOVALVE
U S Patent 2,973,746; Edward C. Jupa, assignor to the United States of America.

EXPANSIBLE RING-SEAL VALVE
U S Patent 2,973,747; Walter E. Folkerts, assignor to Chrysler Corp., Highland Park, Mich.

PRESSURE-RELIEF VALVE
U S Patent 2,973,777; John N. Troxell, Jr., assignor to Cameron Iron Works, Inc., Houston, Tex.

OVERRUNNING COUPLING
U S Patent 2,973,847; Thomas R. Stockton, assignor to Ford Motor Co., Dearborn, Mich.

ELECTROMAGNETIC COUPLINGS
U S Patent 2,973,850; Ralph L. Jaeschke, assignor to Eaton Mfg. Co., Cleveland, Ohio.

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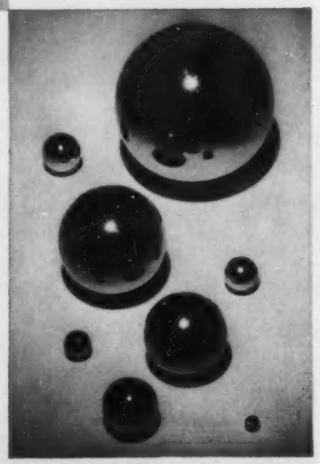

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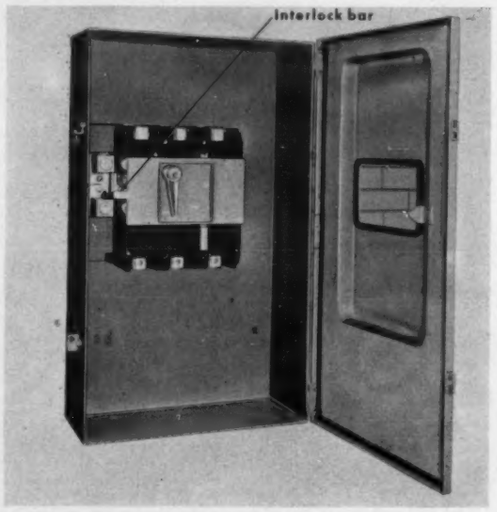
Circuit Breaker's Rotary Handle

Victor W. Wigotsky, Eastern Editor

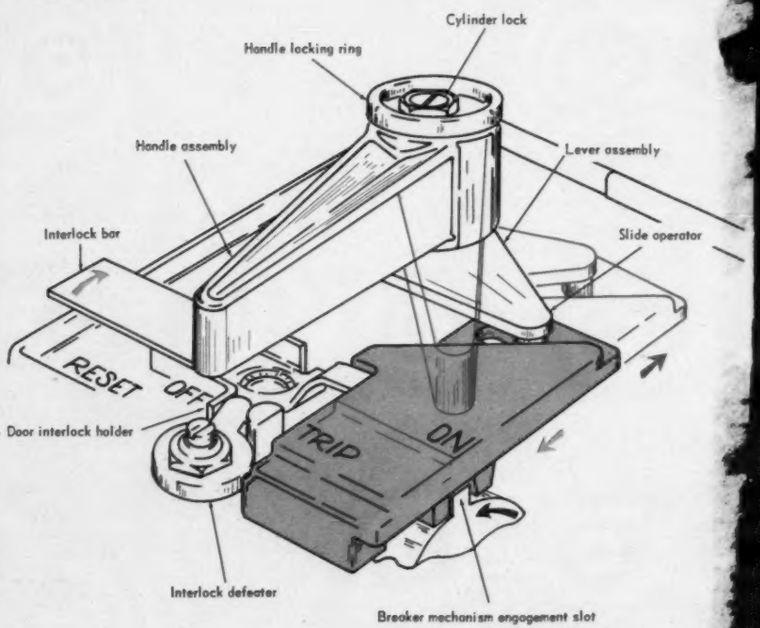


A new rotary-handled circuit breaker always maintains positive contact with its operating mechanism. This departs from the conventional external mechanism which needs accurate alignment with the breaker elements.

The rotary handle is built into the circuit breaker. Rotation of the handle activates a slide operator through a lever assembly. Rotary-lever motion is converted to straight-line motion of the slide to operate an over-center toggle.

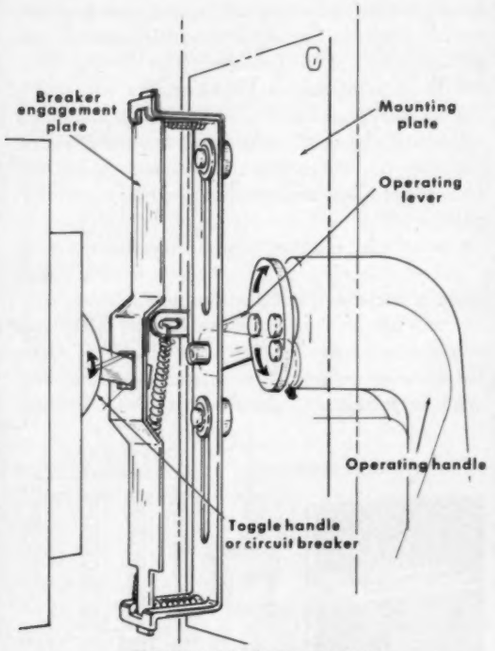
The simple design eliminates disadvantages of the externally mounted handle mechanism. In the latter, a breaker-engagement plate must be aligned precisely with the breaker's toggle handle. Proper operation then depends on maintenance of amount of plate travel relative to the toggle handle. Also, loss of contact of plate with handle would not be indicated visually. Handle position would not neces-

NEW DESIGN: Rotation of handle operates slide through lever assembly bolted to handle. Pin in lever operates in grooved chamber in slide which actuates over-center toggle mechanism in circuit breaker through engagement slit. When handle assembly is rotated to "off", parts return to original position. Door interlock mechanism is additional feature. Small metal bar can be inserted into door interlock holder. Bar engages enclosure door interlock tab and prevents door from being opened unless breaker handle is moved to reset position. Rotating handle to reset position moves slide and pushes tang on door interlock holder, which pivots and rotates bar to release door. Tool can be inserted into interlock defeater to void interlock. Circuit breaker can be locked in either on or off position by inserting key into cylinder lock or by lifting locking ring and attaching up to three padlocks. Lifting locking ring or operating cylinder lock activates a locking bar into a slot at base of handle mechanism.



REDESIGN

Assures Precise Alignment



PREVIOUS DESIGN

PREVIOUS DESIGN: Rotation of external handle moves breaker-engagement assembly in straight line through operating lever. Breaker-engagement plate is in contact with toggle handle. Toggle handle throws breaker "on" when plate moves up approximately 7/8 inch. Entire external linkage is assembled on mounting plate and bolted to door of enclosure. When door is opened and closed, plate must disengage and re-engage toggle handle.

sarily be indicative of the breaker's actual position.

The new rotary-handled design always indicates the true breaker condition, because handle position is related directly to toggle position. This is because the operating mechanism and the breaker itself are always in direct contact for all breaker positions. Alignment is thus built into the system, once installed, as a function of the design.

The rotary-handled circuit breaker for a line from 15 to 800 amps, 600v a-c, was designed by Federal Pacific Electric Co., Newark, N. J.

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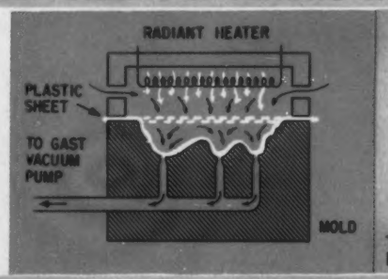
HOW TO APPLY *GAST* VACUUM PUMPS TO SOLVE PRODUCT DESIGN PROBLEMS

VACUUM FORMING OF PLASTIC SHEETS

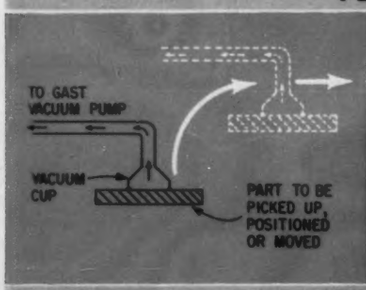
Many engineers are now pushing hard for improved designs on products used for: (1) Lower-cost parts forming, (2) materials feeding and (3) handling, (4) automatic control of machines, (5) faster testing and inspection. To suggest how Gast Vacuum Pumps (used as original components) might help you solve related problems, we offer these 5 examples:

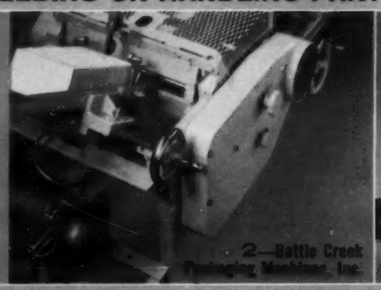
1. VACUUM FORMING of thermoplastic sheet materials. Suction from Gast Model 1065 Vacuum Pump "drapes" heated plastic over male or female mold to make packages, products, parts, etc.



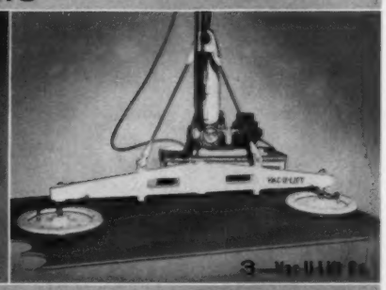
1—Comet Industries, Inc.

FEEDING OR HANDLING PARTS



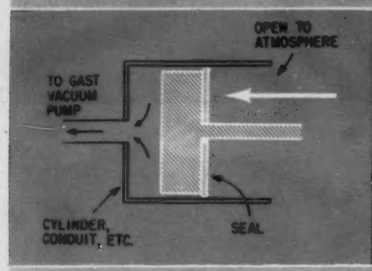


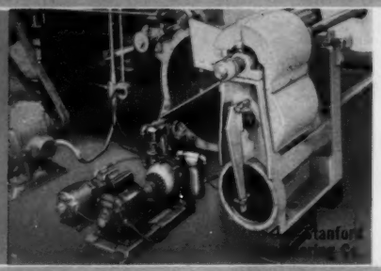
2—Battle Creek Packaging Machines, Inc.



3—Vac-U-Lift Co.

MOVE PISTON OR DIAPHRAGM FOR AUTOMATIC CONTROL





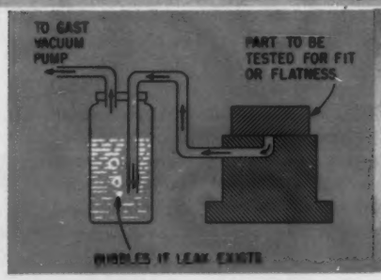
Stanford Packaging Co.

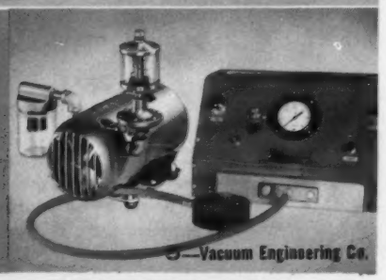
2. VACUUM FEEDER places U-board card into position on conveyor of cake wrapping machine. A ¼ h.p. Gast 0321 Integral-Motor Pump provides vacuum.

3. VACUUM HOIST handles flat stock in weights up to 1,000 lbs. per vacuum pad, using a ½ h.p. Gast Vacuum Pump. Safety device holds if power fails.

4. VACUUM WEB GUIDE for paper rolls prevents edge of paper from wandering, also keeps web tension constant. Two Gast Air Pumps activate controls.

TESTING AND INSPECTION





5—Vacuum Engineering Co.

5. VACUUM TESTER checks surface flatness of parts against a standard. Vacuum level maintained by Gast 0321 Pump energizes "go" or "no-go" lights.

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P.O. BOX 117-G, BENTON HARBOR, MICHIGAN

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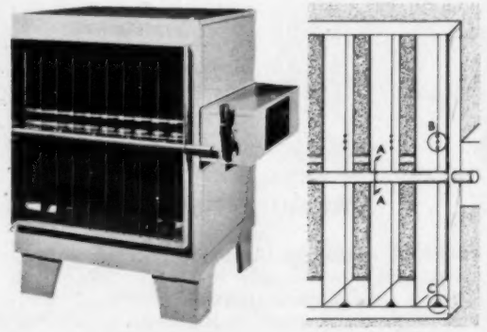
Variable-Voltage Power Pack

E. J. Stefanides, Central States Editor

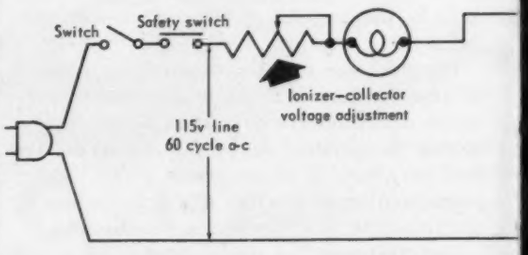
A new electronic air-cleaning unit has been designed to operate over a broad capacity range of central-heating and air-conditioning systems without performance loss. This versatility enables the unit to replace six former models of varying sizes, greatly reducing tooling requirements.

This tooling reduction, coupled with a simpler redesigned electrical circuit and new methods of assembly, has effected a considerable overall reduction in costs over former models of similar quality.

One of the primary design considerations in a unit of this type, which operates over a broad range of air flows, is maintaining the ozone content to a safe level at low flows without sacrificing collector efficiency at high flows. Both of these variables are related directly to the ionizer and collector voltage and the air flow.



ELECTRONIC AIR CLEANER for home and commercial establishments is adaptable to heating systems from 80,000- to 200,000- Btu capacity and air-conditioning systems from 2- to 5-ton capacity. It may be floor mounted or suspended in duct work and is adaptable to both horizontal and vertical operation. Cabinet, ionizer and collec-



NEW POWER-PACK CIRCUIT DESIGN is extremely simple and incorporates variable resistor to adjust ionizer

Maintains Low Ozone Content

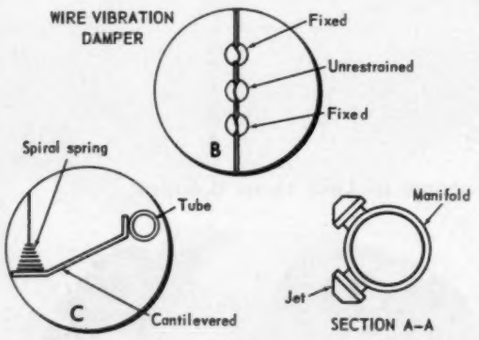
Ozone content must be maintained at a tolerable level, since ozone has an unpleasant odor and toxic properties. The desired level is approximately one in 10 million parts.

In this unit, the problem is solved by providing a variable resistor in the primary circuit of the high-voltage transformer. This allows the ionizer and collector voltages to be varied to suit the air flow of the particular installation.

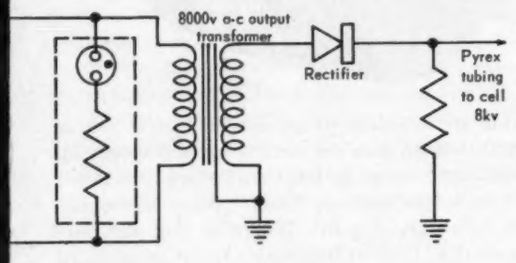
At low flows the unit operates at a lower voltage, keeping ozone production low, while at high flows the voltage is increased to maintain the high collector efficiency.

In practice, the voltage change is accomplished simply by turning a knob to match the size installation marked on the power-pack cabinet.

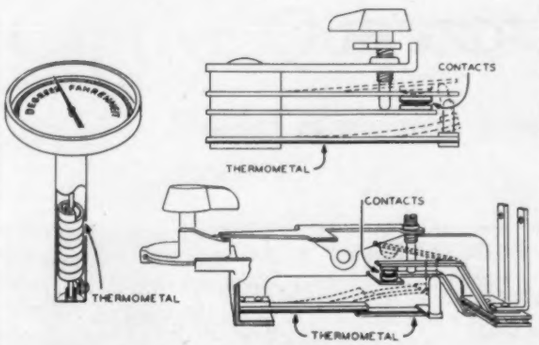
This electronic air cleaner was designed and is manufactured by Trion, Inc., McKees Rocks, Pa.



tor-plate assembly utilize lancing, tabbing and fold-over techniques to eliminate more costly fastening assembly procedures. Ionizer wires are spring-mounted and equipped with sliding-bead arrangement to damp vibration which occurs under low humidity conditions. Water-spray manifold across front allows plates to be cleaned.



and collector voltage to provide high efficiency with low ozone content across entire operating range.



CONTROL TEMPERATURE, CURRENT AND VOLTAGE WITH THERMOMETAL®

Leading manufacturers rely on the dependable performance of Wilco Thermometal in electrical appliances, thermal cutouts, heating controls and many other applications involving the indication and accurate control of temperatures, electrical currents, voltages, etc. Thermometal is supplied in strip form, rolled and slit to close tolerances and tempered to specification. Thermometal elements and sub-assemblies are also supplied to specifications, with or without contacts attached. Send for literature.

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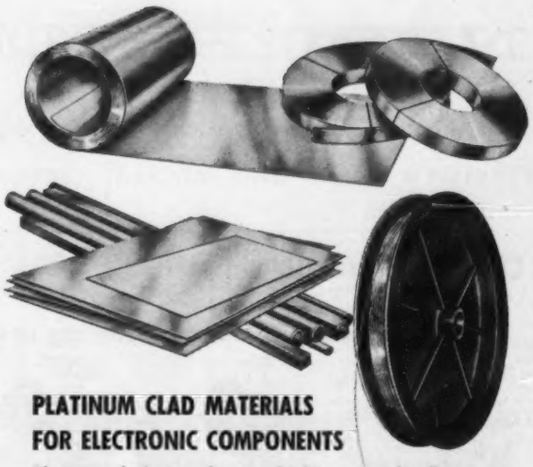

PLATINUM CLAD MATERIALS FOR ELECTRONIC COMPONENTS

Platinum clad wire, sheet and tubing provide all important desirable characteristics of the precious metals at minimum cost for electronic components. Pure or alloyed platinum is securely bonded to base metal with continuous pore-free platinum cladding guaranteed for ensuring reliable functional performance at elevated temperatures. • Gauge of platinum metal can be specified to requirements for economical parts and equipment fabrication. Write for literature.

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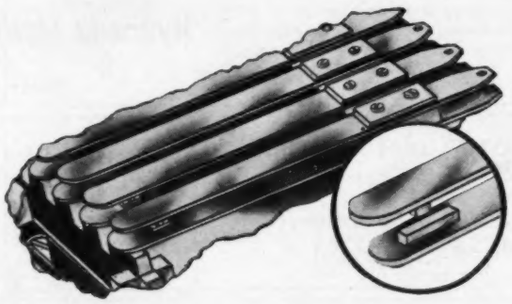

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High reliability welded contacts and contact assemblies available for your relays. Weld strength guaranteed. • Overall contact height held within ±.00025. Assemblies are available in gold, platinum, palladium, silver and their various alloys—both solid and laminated. Single contact usable for various contact ratings, for wet and dry circuitry—assemblies protected for shelf life and handling. Designs for attachment to header by welding or brazing. Complete electrical and mechanical design services available.

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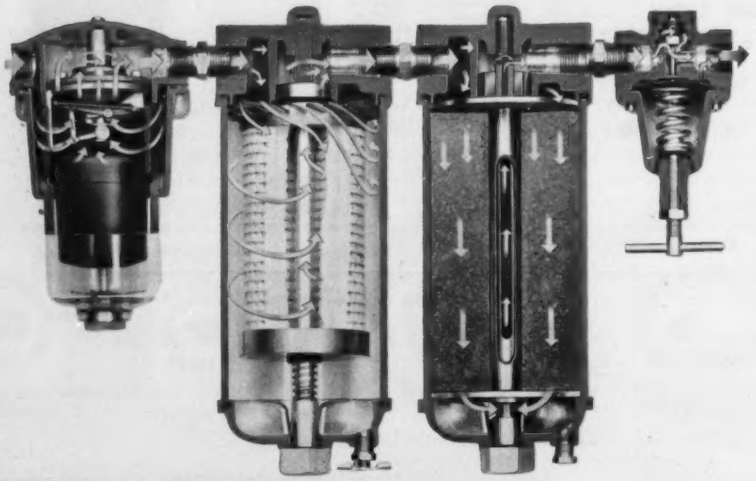
NEW PRODUCTS

For more information on products described, circle on the Reader-Service Card the numbers appearing opposite the story headlines and drop the card in the mail.

Compressed Air Dehydrator 301

Offers Component Flexibility at Low Cost



The "Chem-Guard" dehydrator is made up of standard units, packaged to fit individual needs of a particular application. Rated at a maximum of 10 cfm at 100 psi, the unit will give long service on either intermittent or continuous flows of air. It does not require draining, water or electrical connection. First unit in the package is for removing entrained moisture and small particles of dirt. It is equipped with a built-in automatic drain to keep accumulated contaminants drained off. The second unit is a precision air regulator for controlling pressure. This is followed by an air filter which removes oil fumes, prohibiting them from coating silica-gel desiccant in last unit. This unit is a dryer capable of lowering dew-point of air to —65F. Dehydrator does not need reactivating. A separate replacement desiccant charge is less costly and is vacuum packed in a sealed can containing exactly the right amount that can be stored indefinitely. Entire desiccant is visible in unit. This package is available as shown or can be purchased with any one of the units omitted. The complete system is useful for installation before paint-spraying operations, pneumatic instruments, air-operated gages (where air is used in glass-blowing or making plastic bottles) and other applications where the purest air is required.

Wilkerson Corp., 1649 W. Mansfield, Englewood, Colo.

Miniature D-C Solenoid 302

Has 12-Millisec Response Time

A two-coil d-c solenoid, model 12SD535, has met two million cycles of operation. Suited for business-machine and key-punch applications, the unit measures 1.125 inches in dia and operates over an ambient temperature range of —65 to 160F. It can also be designed to meet general requirements of MIL-S-4040C. Solenoid response time is rated as 12 millisec minimum with a force of 1 lb at 0.125-inch stroke and at 60v d-c. Temperature rise within unit is kept to 40F maximum.

IMC Magnetics Corp., Marketing Div., 6058 Walker Ave., Maywood, Calif.

Hydraulic Clutches 303

Shift, Engage in Less than 0.6 Sec

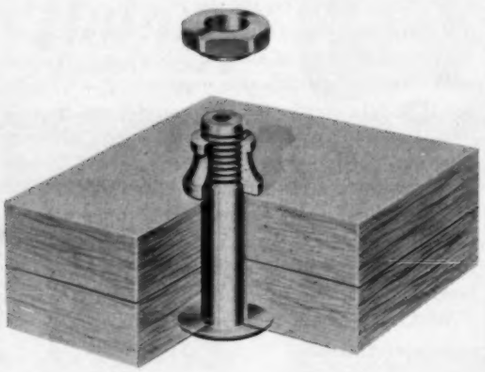
Dual-drive design clutches are available in six sizes to handle torque loads from 1000 to 10,000 lb-ft, engines up to 1000 hp and speeds up to 5500 rpm. Clutches shift and engage in less than 0.6 sec. When disengaged, clutch cavities are under constant lube-oil pressure, furnishing efficient lubrication to all clutch parts. Design of this unit provides adjustment-free operation, built-in lubrication, pressure-balanced drives, low inertia characteristics and compact size.

Borg-Warner Corp., Rockford Clutch Div., Rockford, Ill.

High-Strength Fastener 304

For Structural Requirements

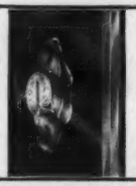
The "Hi-Lok" fastener overcomes two troublesome problems—installation in very restricted structural areas and crazing or cracking of plastic structural materials. The unit can be rapidly and quietly installed in a variety of tight clearance areas, as well as in open areas. Fastener is installed with standard, inexpensive air drivers fitted with a variety of adapter tooling designed in straight, offset and extended configurations. The fastening device is basically a threaded unit combining advantages of a nut and bolt with those of a rivet. A threaded pin and self-locking threaded collar are included. When assembly of collar and pin is completed, wrenching device is automatically torqued off at predetermined design preload consistent within ±10 percent, regardless of fastener size. The BUS330 uses type 305 stainless steel in buttonheaded pin and type 303 stainless steel in collar. Nominal diameter sizes include ¼ through ½ inch. This unit features a ¼-inch grip variation to accommodate a wide tolerance in material thickness—clamp-up and ultimate tensile values remain consistent in maximum and minimum grip conditions.



Hi-Shear Corp., 2600 W. 247th St., Torrance, Calif.

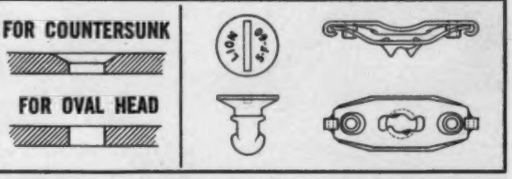
Captive Quick-Opening Fasteners:

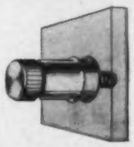
Southco standards provide many benefits at low cost for access through doors, covers, panels and into drawers



LION ¼ TURN FASTENERS

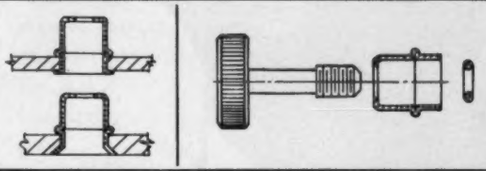
Quick, positive locking, by fractional turn. Tight seal formed by compression of leaf spring. Alignment and stack height not critical. Approved for aircraft use. Rugged. Extra strength provided by swaged nose. Vibration resistant.





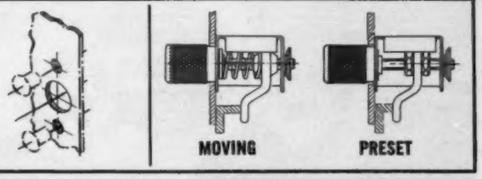
RETRACTABLE SCREW FASTENERS

Stand-off thumb screws from stock to eliminate costly, special fasteners. Installed quickly without special tools. Accommodate misalignment. Complete range of standard sizes.



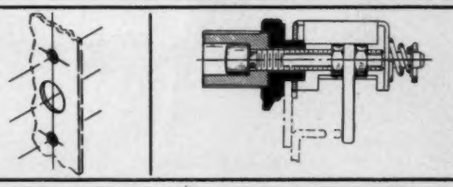
ADJUSTABLE PAWL FASTENERS

Pre-assembled, quickly installed. Accommodate variations in frame thickness up to ½ inch. One-quarter turn closes, additional turns increase grip pressure. Attractive appearance, long life. Moving or pre-set pawl. Miniature, intermediate and large sizes.



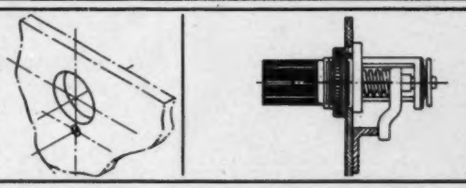
ADJUSTABLE PAWL FASTENER

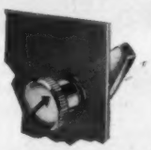
Has twin-knob control. One knob controls pawl, pointer shows pawl position. Other knob controls amount of pressure to seal closure with uniform pre-set compression. Easily installed.



ADJUSTABLE PAWL FASTENER

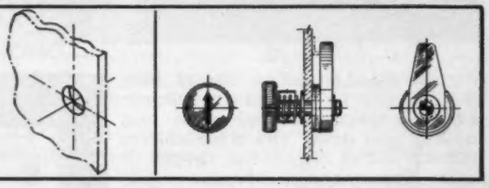
Compact and rugged. Eliminates rivets or bolts to save installation time. Three types cover grip range up to ¾". Supplied either with integral metal and plastic knob, plastic knob or for your knob.





ARROWHEAD DOOR LATCH

Requires only one hole to install. Operates on quarter turn. Holds under spring tension. Arrow shows pawl position; no pawl stops required. Uses minimum inside space.



Free Fastener Handbook

Send for your complete Southco Fastener Handbook, just printed. Write to Southco Division, South Chester Corporation, 232 Industrial Highway, Lester, Pa.

SOUTHCO FASTENERS
LION

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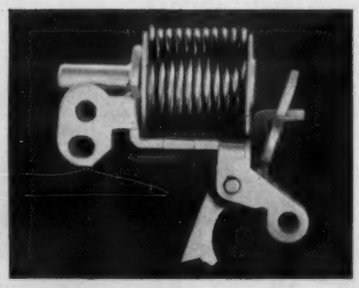
Circle 50 on Reader-Service Card for more information

Most overload-protection devices have to be de-rated for elevated temperatures. As the ambient goes up, usable load capacity goes down. This is an inherent characteristic of thermal-type devices.

The Heinemann circuit breaker is magnetically actuated. It senses overcurrent not through a heat-sensitive bi-metal strip, but through a solenoid coil. The calibrated current capacity of the coil is unaffected by temperature.

If you put a Heinemann breaker in a hot, component-packed equipment enclosure (even next to a bank of tubes), it will



carry 100 per cent rated load without tripping. It will trip only when it's supposed to. And always at the precise overcurrent value specified.

These temperature-stable characteristics are common to the entire line of Heinemann hydraulic-magnetic circuit breakers. You can have any of them (including the subminiature Series VP shown here) in any integral or fractional rating you need, from 0.010 amps on up, and with any of several inverse time delays. Our Engineering Guide, Bulletin 201, will give you detailed information.

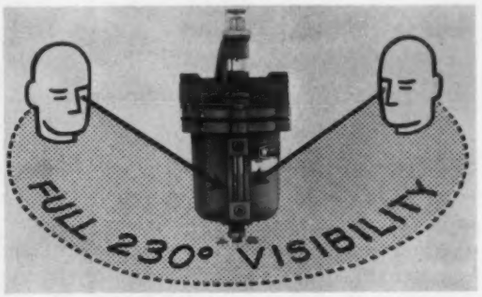
HEINEMANN ELECTRIC COMPANY ◆ 105 BRUNSWICK PIKE, TRENTON 2, N. J.

SA 2370

Circle 51 on Reader-Service Card for more information

MECHANICAL

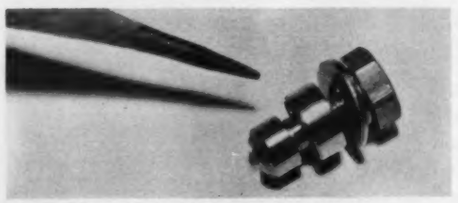
Safety Filter Bowl 305



Air filters and lubricators can now be equipped with a "Saf-T-Bowl"—a metal unit with a sight-level indicating gage. This product is proposed as the answer to new restrictions imposed by safety departments on the use of plastic for reservoirs on compressed-air products. The all-metal reservoir is die-cast of a zinc alloy and is equipped with a sight-level indicator made of "Pyrex" tubing. The tube is protected from accidental impact by a thin metal strip running full length in front of indicator. Level of contents is visible a full 230 deg. When installed on an air line, sight gage can be rotated easily to face in any desired direction. The device is impervious to high temperatures, high pressures, steam cleaning, solvents, synthetic compressor oils and high impacts.

Wilkerson Corp., Englewood, Colo.

Precision Cam Followers 306



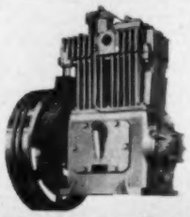
Miniature stainless-steel precision cam followers, with outside diameters ranging from ¼ to ⅝ inch, are useful in close-quarter timing applications. Available in face widths from 0.1406 to 0.1960 inch, units incorporate a shielded ABEC 7 tolerance ball bearing fitted on a concentric ground shaft to provide full-contact tracking and smooth operation. Units are furnished with spacers, lock washer and hex nut.

PIC Design Corp., 477 Atlantic Ave., East Rockaway, Long Island, N. Y.

loadless starting

ANOTHER BIG REASON TO THINK ABOUT Quincy COMPRESSORS

LOADLESS STARTING is an exclusive, patented QUINCY feature that eliminates a compressor starting load at all times. Loadless starting puts an end to noisy and troublesome check valves. This outstanding design feature is recommended for automatic start and stop units.



Quincy COMPRESSORS

QUINCY COMPRESSOR CO., Quincy, Illinois
Makers of the World's Finest Air Compressors

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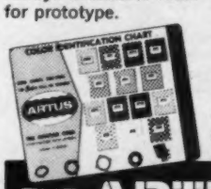
NEW THE COLOR TELLS THE THICKNESS

ARTUS **100 SHIMS THIS SIZE**

Send blueprint for shape required. Special tooling, first order only $9.75.

Real time savers in production and maintenance. Used by thousands including America's best known companies. More efficient, more convenient. Always available. Ideal for prototype.



FREE — Handy COLOR CHART, also samples and literature. Write today!

THE ARTUS CORPORATION
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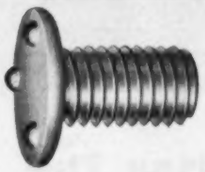
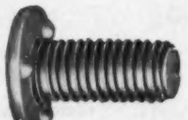
OHIO WELD SCREWS



GW SCREWS — Used where design requires a smooth unmarred surface and a fastener permanently fixed in place.

HH SCREWS — Used where a single, button-type projection is required when welding to curved surfaces, to heavy sheet 3/32" or thicker, or to ends of rods.

RW SCREWS — Used where a hermetic seal is required to prevent leakage of air, gas, water, oil or dust, or when welding to perforated metal or wires.



HW SCREWS — Used where a self-locating through bolt is required to be fixed securely in place so that it will not turn and a flush surface is required for attaching mating parts.

Thread Size #6-32 to ⅜-16

Samples and information available upon request.

The WELD FASTENERS Primary Fastener in Fastener Assemblies

THE OHIO NUT AND BOLT CO.
29 FIRST AVENUE, BEREA, OHIO

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UNLIMITED MANIFOLD MOUNTING
OF VERSA SERIES "A" SOLENOID VALVES

WITH VERSA

Co-Ordinates

■ Now...You can mount an unlimited number of Versa Series "A" Solenoid Valves as one integrated unit with these new Versa Co-Ordinate Assemblies. These assemblies make possible simplicity of design in both Hydraulic and Pneumatic operation, because only one inlet is required to feed the entire line of valves. Additional blocks can be added at any time and blocks with and without adjustable built-in bleed controls can be used together in one unit. ■ Combined with Versa Series "A" Valves these Co-Ordinates provide the most flexible and reliable Multiple Solenoid Valve Assemblies in the Control Valve field. Write for Bulletin # 960.

VERSA Valves

VERSA PRODUCTS COMPANY, INC.
150 Coolidge Ave., Englewood, N. J.

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NOW POLYPROPYLENE PLASTIC CLAMPS

7 SIZES ⅛" TO ½" DIA.

NEW LOW COST ...much less than other types!

STRONG—toughest plastic clamp made . . . high tensile strength. Tougher 'n 'ell!

MOLDED to uniform size and shape, smooth edges.

DURABLE—for outdoor or indoor use. Excellent dielectric properties. Resist solvent, grease, oil, etc.

FREE SAMPLES

SEND SAMPLES OF PLASTIC CLAMPS

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476 ELM STREET • SYCAMORE, ILL.

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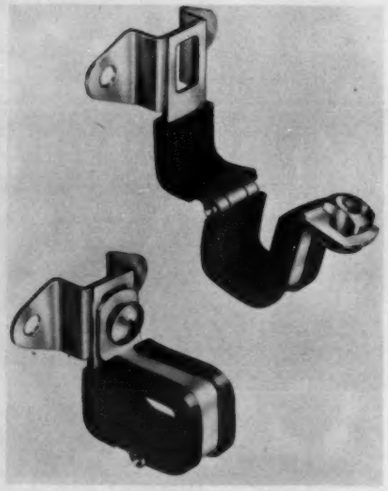
'Teflon'-Stainless Bushing 307

Stainless-steel bushings with reinforced "Teflon" inserts permanently bonded to the inside diameter are said to greatly reduce friction, thereby reducing the torque required to actuate a shaft. According to the manufacturer, "Fluor-O-Bearings" are particularly suitable to applications involving liquid oxygen or other exotic fluids. A special design technique encapsulates glass cloth in the "Teflon", increasing wear characteristics and virtually eliminating cold flow.

Fluorocarbon Co., 1754 S. Clementine, Anaheim, Calif.

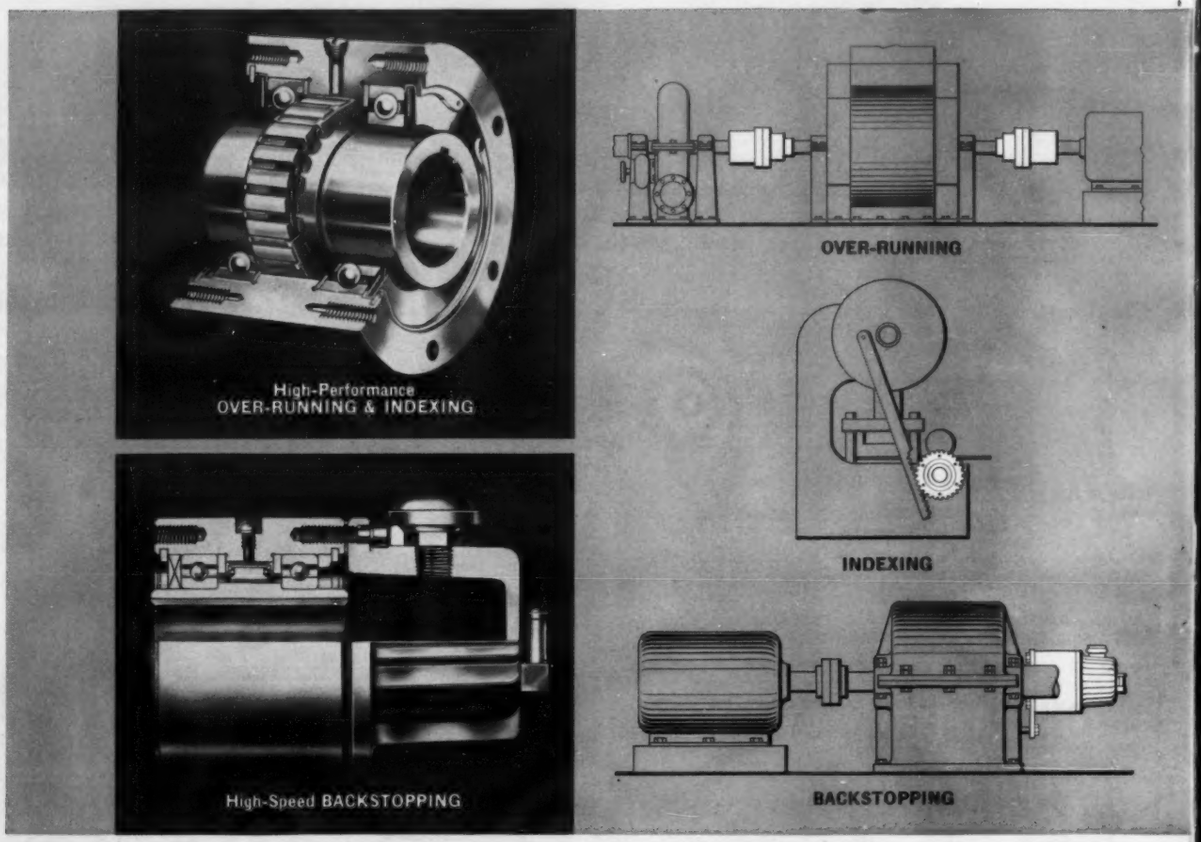
Rectangular Fasteners 308



Eighty percent of installation time can be saved with this line of quick-attach/detach "Flip-Loc" fasteners, offered in almost any square or rectangular shape. The unit has a built-in hinge and fast-action key nut for securing fastener and allowing any degree of mechanical take-up desired. Once installed, this fastener may be opened or closed indefinitely without fatigue on the metal. All components are captive.

TA Mfg. Corp., 4607 Alger St., Los Angeles 39, Calif.

FORMSPRAG Clutches have



These Installations Prove Formsprag Has The Most Advanced Clutch Designs Available

On tough applications requiring high-performance over-running, indexing or backstopping, Formsprag clutches have *proved* their unusual durability, precision and reliability. Their long-life and minimum maintenance requirements, even under unusually demanding installation conditions, have provided many users with the answer to their clutch problems. Compare the following performance results on actual installations—Formsprag designs can help you, too!

High-Performance Over-Running

Application:
Forced and Induced Draft Fans.

Clutch and Mounting:
Model FO-732 Clutch-coupling (HPO-720 clutch with coupling) mounted on fan drives.

Requirements:
Continuous over-running at 1200 to 1800 R.P.M. (24 hours a day, 365 days a year).

Proved Results:
The Formsprag HPO clutch design with Formchrome sprags provides this company with greater durability and less maintenance than any other available clutch. Therefore, on all forced and induced draft fans, this manufacturer specifies Formsprag high-performance over-running clutches.

Precision Indexing

Application:
High Speed Press.

Clutch and Mounting:
Model HPI-700 feeding a progressive die.

Requirements:
20° indexing; feed is 700 strokes per minute; accuracy of feed must be within .005"; press operates 24 hours a day, 5 days a week.

Proved Results:
After poor service life and unreliable results from other clutch designs, a Formsprag high-performance indexing clutch was installed. Result—customers requirements for accuracy were met, clutch has had a life of 80 million cycles and is still running.

proved higher performance

(GREATER TORQUE & SPEED, HIGHER PRECISION, LONGER LIFE)

During the last two years, Formsprag has announced several major advances in over-running clutch design. These advanced concepts have been widely accepted by designers of modern power transmission systems. The high performance results they obtained on over-running, indexing and backstopping applications *prove* Formsprag clutches to have the most advanced designs available.

On-the-job records *prove* these high performance characteristics: (1) Formchrome sprags, with high-hardness and wear resistance, provide exceptional durability—no other manufacturer can offer the performance advantages of Formchrome sprags. (2) The improved sprag and retainer design of Formsprag High-Performance Over-running (HPO) and Indexing (HPI) clutches permit up to 30% higher operating speeds with same life span and up to 70% longer clutch life when operated at same RPM as ordinary clutches. (3) On backstopping applications, the High-Speed Backstopping (HSB) clutch design permits higher speeds, assures longer life and reduces maintenance to a minimum.

Specific case-history data on *proved* over-running, indexing and backstopping installations is provided below. In every instance, users of Formsprag High-Performance Clutches have found the answers to problems of wear, high-speed operation, precision and maintenance.

There is a Formsprag Clutch for every application. Standard models include: sleeve bearing, ball bearing, miniature, large-bore holdbacks, and high-performance types. For special applications, Formsprag engineers will recommend a modified standard clutch or design a special. Standard clutches are fully described in the Formsprag catalog—send for your free copy.

FORMSPRAG COMPANY

23605 Hoover Road, Dept. 114-A — Warren (Detroit), Michigan

Representation Throughout The World • Precision Power Transmission Products

High-Speed Backstopping

Application:
Iron Mining (Taconite) Conveyor.

Clutch and Mounting:
Model HSB-700 clutch assembly mounted on high-speed shaft of reducer.

Requirements:
In abrasive atmosphere, clutch must over-run at 1200 to 1800 R.P.M. (24 hours a day, 9 months of year).

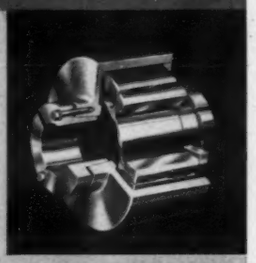
Proved Results:
On this rugged backstopping application, Formsprag HSB clutches solved problems of overheating, premature seal wear, and short clutch life. These high-speed backstopping clutches have been in operation for over a year and are still delivering their initial high performance.

OTHER FORMSPRAG PRECISION PRODUCTS

NEW RAWSON

CENTRIFUGAL CLUTCHES and CLUTCH-COUPLINGS

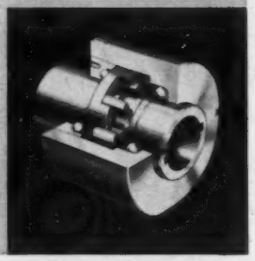
Used in a wide variety of applications, the Rawson design provides no-load starts for motors and cushioned starting of driven equipment. They permit using smaller motors and across-the-line starting.



REVLOK

DUAL TORQUE-LOCKING and POSITIONING DEVICES

These multi-purpose devices stop feedback torque and provide two-directional positioning, over-running, backstopping and load-limiting. They can also be adapted for single revolution and torque-limiting functions.



Circle 58 on Reader-Service Card for more information

Spring-Ejected Panel Fastener 309

When this access panel fastener is disengaged, the unit automatically pops into fully retracted position. The chrome-plated screw assembly is retained in a specially-designed stand-off flanged into door or chassis panel. Operating in a tapped hole or insert in frame, it provides zero inside projection when unfastened. Because of its spring-loaded design, when fastener is disengaged it is firmly held in full retraction, providing clearance for panels to move laterally with respect to one another. No. 53 fastener assembly is offered in stainless steel in seven thread sizes from 8-32 to 1/4-28 and three head sizes, with or without slots.

South Chester Corp., Southco Div., Lester, Pa.

Gear Assembly 310

A gear box is available in a variety of ratios and shaft rotations, and features easy disassembly for simple gear-lash adjustment. Steel-cut gears on ground shafts of stressproof steel turn on Timken roller bearings and smoothly and efficiently transmit up to 45 hp. Input rotation may be either clockwise or counterclockwise. Unit is available in 1:1, 1.5:1 and 2:1 ratios or reverse ratios. On 1:1 units, forged or hardened forged gears may be used. Shafts may be pinned, keyed or splined and may be of length to fit the particular application.

Von Ruden Mfg. Co., Claremont, Minn.

DOES YOUR OIL SEAL VENDOR ACCEPT QUALITY CONTROL AS *HIS* RESPONSIBILITY?

To insure performance from their products, manufacturers constantly look for means of assurance that their purchased components are manufactured to high standards. In many cases this requires costly inspection, sorting or testing.

If you conduct such tests on Oil Seals, for example . . . How well equipped must you be? What size sample should you take? How proficient must your inspection be?

We can tell you – *in fact we can show you* . . . for IPC has pioneered the most complete, exhausting QC procedures that exist anywhere in the Oil Seal industry. Modern equipment operated by highly skilled technicians control every phase of IPC's production.

That explains increasing demand for IPC products. It also explains why our customers have fewer inspection headaches.

Why not get your next Oil Seal problem to IPC? You can rely on our "custom" approach to your problem and we will be happy to show you the elaborate QC steps that will insure the results *you* want.

IPC
OIL SEALS
PACKINGS
PRECISION MOLDING *Custom designed for your application*

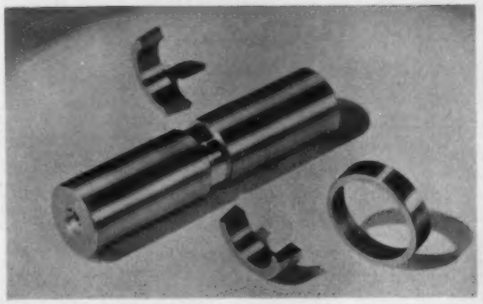
INTERNATIONAL PACKINGS CORPORATION

© IPC

Bristol, New Hampshire P3

Circle 59 on Reader-Service Card for more information

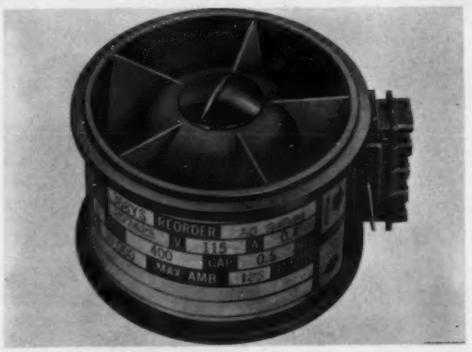
Shaft Collar 312



A conical-shaped split inner ring and locking retainer ring are combined in the "Taper-Lock" shaft collar. It withstands high thrust loads in one or both directions and provides accurate location for shaft-mounted parts. Split inner ring locks into shaft, eliminating turned shoulders. Quick assembly is completed by tapered fit of inner ring and retainer. The device can be used to connect air or hydraulic cylinder shafts to other members in high-thrust load applications. The collar is available in all sizes up to four inches in dia, external or internal types.

Bearing Accessories Co., 7320 Lake Shore Blvd., Mentor, Ohio.

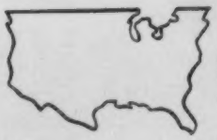
Servomount Fan 313



The compact, high-capacity "Aximax 2" fan is now available with a servo-ring mount. Unit is supplied complete with stainless-steel, fillister-head, cam-acting clamps for easy mounting. Use of servomount with fillister-head screws permits equipment user to remove fan at any time by merely loosening screws and slipping servo-ring out from screw assemblies.

Rotron Mfg. Co., Inc., Woodstock, N. Y.

Circle 60 on Reader-Service Card

wherever  you are, there's a

Cullman Distributor!

Cullman Distributors are located from coast to coast and border to border; therefore you are assured of always getting fast service on Cullman power transmission products. When you want Sprockets, Roller Chains, Flexible Couplings—call on Cullman for prompt delivery.

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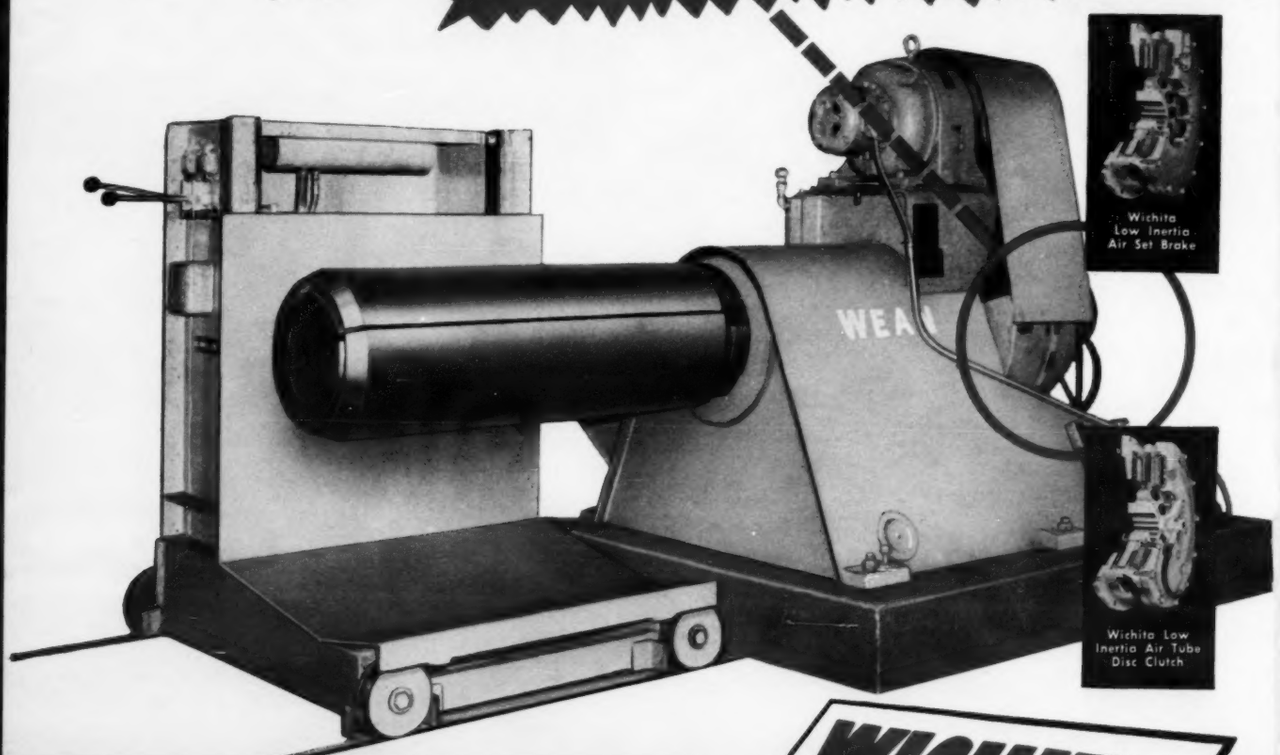
Roller Chain Drives Since 1893

WEAN has standardized on WICHITA BRAKES for this uncoiler

"The illustration shows one of our 52" overhung mandrel uncoilers which is equipped with a Wichita Air Brake," says engineer Krepp of the Wean Equipment Corporation. "We have standardized on Wichita Brakes for this class of uncoiler because of better design, trouble-free operation and performance. We have found that Wichita Brakes give us considerable leeway on size." For peak performance in clutches and brakes on any equipment it will pay you to standardize on Wichita . . . contact your nearest Wichita engineer today!

"Better Design... Trouble-Free Operation... and Performance,"

says J. D. Krepp, Wean Senior Staff Engineer



Wichita Low Inertia Air Set Brake

Wichita Low Inertia Air Tube Disc Clutch

CONTACT YOUR NEAREST WICHITA ENGINEER

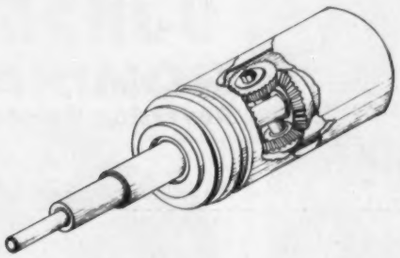
Clutch & Control Engineering Co., Hyando, Mich.
Fremont & Lewis, inc., Cincinnati, Ohio
W. O. Kerr Company, Pittsburgh, Pa.
Smith-Keser & Co., Avon, Conn.
Philadelphia 48, Pa., and New York, N.Y.
Frank W. Yantiss Co., Chicago, Illinois
Larry W. McDermott, Long Beach, California
Andrew T. Lybel, Denver, Colorado
Robert E. Fling Co., Cleveland, Ohio
Thurston Williams, Houston, Texas

Allied Transmission Equipment Co.,
Kansas City 8, Missouri
Donald E. Hermann, Dallas, Texas
C. Arnold Weaver, Richmond, Virginia
Malcolm S. Cone, Memphis, Tennessee
Dominion Power Press Equipment Ltd.,
Burlington, Ontario, Canada
J. F. Cunz, Seattle 4, Wash.
Herman Fropp Co., Portland 4, Ore.
Reese Sales Co., St. Louis 3, Mo.
The Alfred Hallbery Co., Louisville, Kentucky

WICHITA Clutch COMPANY, INC.

WICHITA FALLS, TEXAS, U.S.A.

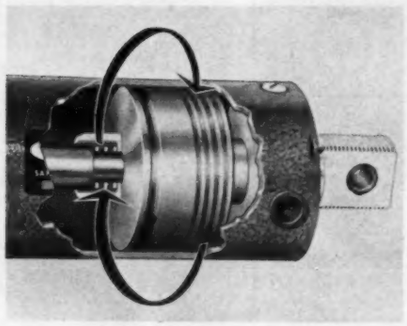
Single-End Enclosed Differential 314



The T753 differential is manufactured in BuOrd sizes 5, 8, 11, 15 and 18 and has been engineered for high-speed rotation, minimum backlash, low break-away torque and maximum rotational torque output. Differential has precision ball bearings throughout and is of stainless-steel and aluminum construction.

Sterling Precision Corp., Components Div., 5 Sintsink Dr., Port Washington, Long Island, N. Y.

Adjustable-Stroke Cylinders 315

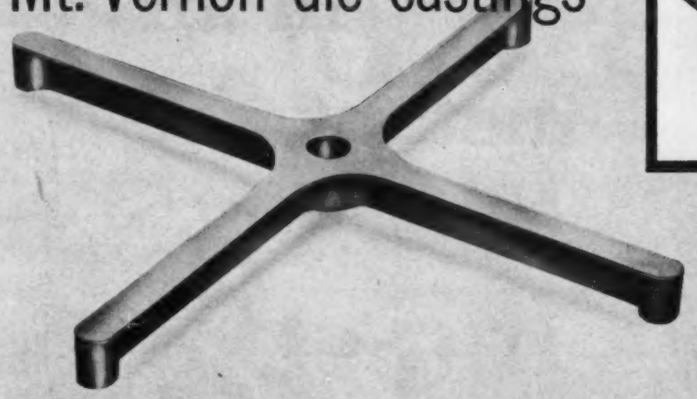


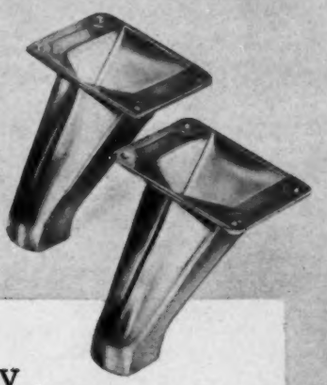
Designated "Adjust-O-Stroke", this device uses a series of 1/16-inch-thick spacing washers to position piston on piston rod. Cylinders are manufactured in stock stroke lengths in increments of one inch. If the user requires a fractional-inch stroke length, such as 10⅝ inches, he may order an 11-inch stock length. By removing six front spacing washers and adding a corresponding number of rear spacing washers, stroke length is reduced to 10⅝ inches without disturbing mounting dimensions.

Modernair Corp., 400 Preda St., San Leandro, Calif..

Circle 61 on Reader-Service Card

Steel furniture manufacturer gets **these 5 benefits** from Mt. Vernon die castings





CASE HISTORIES FROM MT. VERNON FILES

Subject:

Art Steel Company, New York City

In a major switchover, Art Steel Company makes this handsome Steelmaster Desk with aluminum die cast legs. The companion Executive Chair stands on a die cast aluminum base. Formerly it took 8 parts to assemble each island leg of the desk... and 14 parts for the chair base. But switching to die cast parts gave Art Metal Company 5 major benefits:

1. Simpler fabrication since all castings are one-piece integral units. No more multiple section subassembly work.

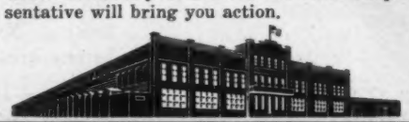
2. Complete freedom in designing due to the many inherent advantages of the die casting process.

3. Corrosion of legs and bases caused by office cleaning detergents no longer a problem. Aluminum die castings stay bright and attractive.

4. Die castings are delivered polished, drilled and tapped, ready for use. Several assembly steps previously required have been eliminated.

5. Because production of legs and bases has been put into Mt. Vernon, valuable production capacity at Art Steel has been freed for other requirements.

More and more, in a great variety of products, Mt. Vernon Die Castings are replacing complex sheet metal assemblies and costly, crude sand castings, bringing significant production economies to the manufacturer. All the knowledge we have gained on this subject is also available to you... free. Why not discuss your problem with us too. A call to your nearest Mt. Vernon representative will bring you action.

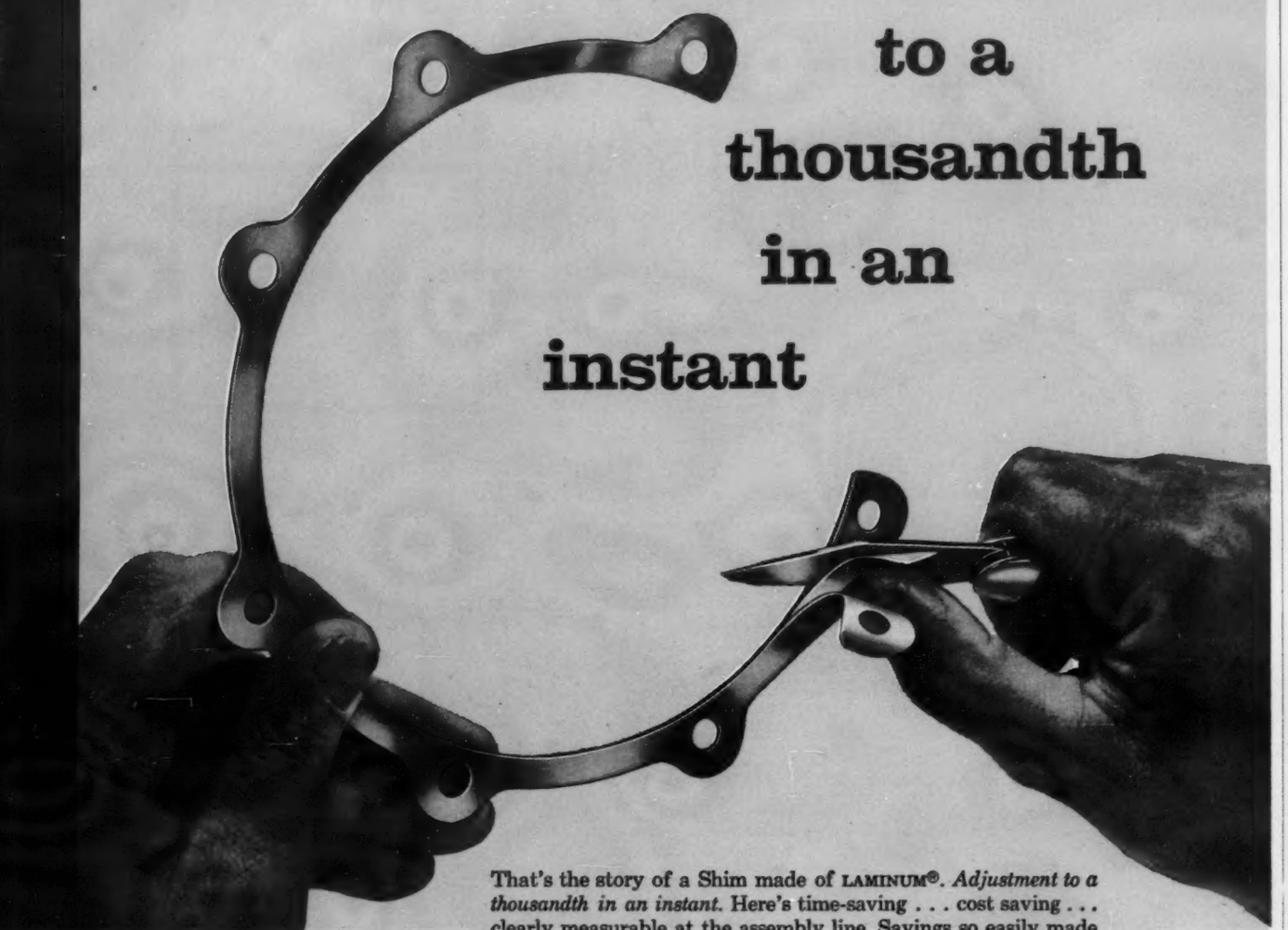


MT. VERNON DIE CASTING CORPORATION
STAMFORD, CONNECTICUT

SALES REPRESENTATIVES
BALTIMORE, MD.: Mr. C. M. Gordan, 919 St. Paul St.
BROOKLYN, N. Y.: Mr. Robert V. Moore, 2317 Plumb 2nd St.
CLEVELAND, OHIO: Mr. Grant Eller, 6 East 194th St.
MARIETTA, N. Y.: Mr. Burt J. Meldrum, Olanco Road
PITTSBURGH, PA.: Mr. Andrew W. Anderson, 300 Pasadena Drive So.
STAMFORD, CONN.: Mr. Anker Anderson, Cascade Road
VALLEY FORGE, PA.: Mr. G. T. McMaster, P.O. Box 115

Circle 62 on Reader-Service Card for more information

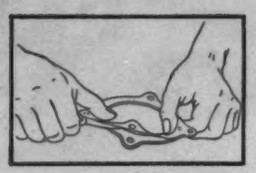
Adjustment to a thousandth in an instant



That's the story of a Shim made of LAMINUM®. *Adjustment to a thousandth in an instant.* Here's time-saving . . . cost saving . . . clearly measurable at the assembly line. Savings so easily made with the p-e-e-l of a knife.

LAMINUM is the registered trade name for laminated shims, surface bonded in metallic or plastic to look, act and feel like a solid piece of metal. Yet each lamination is easily p-e-e-l-e-d to bring your shim down to an exact fit—right on the job.

No machining. No grinding. No counting. No stacking. No miking. No costly stand-by equipment. And custom-made—in any quantity—to your exact specifications.



Available in brass, mild steel, stainless and aluminum . . . .002" or .003" laminations as you desire.

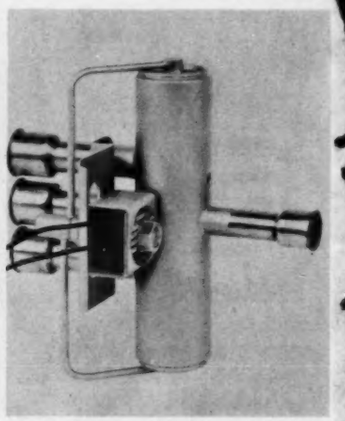
To find how LAMINUM can save you time and money just write for the revised SHIM DESIGN FOLDER No. 4. Here's complete, up-to-the-minute engineering data on Laminated Shims for your own assemblies. Send for this booklet today!

LAMINUM®

THE LAMINATED SHIM COMPANY, INC.
West Coast Sales and Service - 600 Sixteenth St., Oakland, Calif.
Home Office and Plant - 1104 Union St., Glenbrook, Conn.

Four-Way Reversing Valves 316

An all-metal, four-way reversing valve controls refrigerants in reverse-cycle air-conditioning systems, heat pumps and hot gas defrost applications. "KV44" features hermetic valves with full ported poppet-type pilot valve and plastic encapsulated coils. Pilot valve is mounted to main valve, permitting a shift of main slide valve with both low and high-system pressures. All-metal construction, with precision-ground pistons and honed bore on main valve, permits



use of brazing temperatures commonly encountered in air conditioning assembly without harming valve. Operating specifications include: coil voltage, all commercial voltages, a-c; continuous coil power requirement, 18v a-c, (inrush, 29 volt-amperes); maximum operating pressure differential and safe working pressure, 500 psi, and minimum changeover pressure differential, 40 psi.

General Controls Co., 801 Allen Ave., Glendale 1, Calif.

Circle 63 on Reader-Service Card

SPHERCO®
BEARINGS

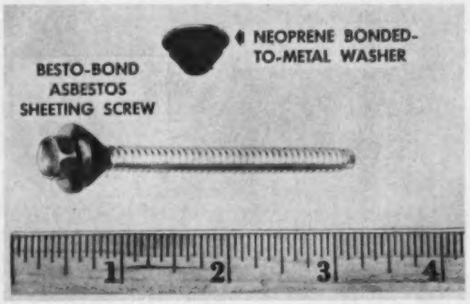
If you have applications involving linkage or transfer of motion, SPHERCO Bearings can supply your needs in a wide variety of materials with a quality that will give you top performance under normal or high temperature conditions.

WRITE FOR BULLETIN 560

SPHERCO
A PRODUCT OF
SEALMASTER BEARING DIVISION
STEPHENS-ADAMSON MFG. CO.
29 RIDGEWAY AVE. • AURORA, ILL.

Circle 64 on Reader-Service Card

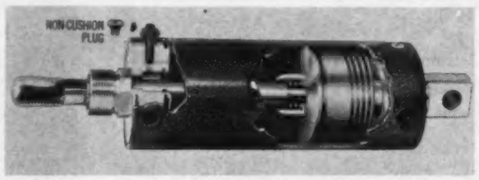
Sealing Composite Washer-Fastener 317



Faster structural application of corrugated asbestos sheeting to girts and purlins with low torques is possible with "Besto-Bond" sheeting screws. This line is provided in both types B and A sheeting screws, preassembled with a composite washer. The latter consists of an elongated cone-shaped neoprene seal of approximately 65 durometer bonded to ⅝-inch dished metal washer. Application of minimum screw torques causes dished metal washer to focus pressure on tapered neoprene, providing a watertight seal. Washer assembly design permits normal expansion and contraction of sheeting without stress. Use of lower torques prevents extrusion of neoprene beyond washer face, resulting in a neater joint while protecting seal from direct sunlight and ozone deterioration. Type B screws and side lap bolts are available in either 305 stainless-steel (cadmium-plated and waxed) or carbon-steel (cadmium-chromate plated). Washers are of 302 stainless. Samples are available.

Atlas Bolt & Screw Co., 1111 Ivanhoe Rd., Cleveland 10, Ohio.

200-PSI Cylinders 318



Air or hydraulic cylinders, for 200-psi operation, incorporate "Adjust-O-Stroke", providing easy adjustment of stroke lengths in one-inch increments to fractional-inch stroke length requirements. Mounting brackets are interchangeable. Series R cylinders are offered in 1⅛-, 1½-, 2-, 3- and 4-inch bore sizes.

Modernair Corp., 400 Preda St., San Leandro, Calif.

RELIABILITY
is built right into
Hackney-made components

Hackney forming methods produce strong, lightweight, seamless shells the cold drawn way. With smooth, clean surfaces, consistently uniform side walls and closely controlled tolerances, performance reliability becomes an integral part of every Hackney deep drawn shape or shell.

You will find plenty of design latitude in our methods because we make available to you a vast assortment of dies, mandrels and related tooling to match your ideas. Units can be made in sizes from 1 qt. to 100 gal. Diameters range from 2" to 32". Lengths may be from ½ to 5 times the diameter, or up to 110"...working pressures to 10,000 psi, depending on diameter.

Hackney experience and facilities can form your components in steel, magnesium, nickel, ultra-high-strength stainless steels, hot work tool steels, molybdenum or titanium. Let our engineers help you work out details and suggest ways to improve reliability...reduce cost. For complete information, write to the address below:

Pressed Steel Tank Company
Manufacturer of Hackney Products Since 1902
1440 South 66th Street, Milwaukee 14, Wisconsin
Branch offices in principal cities

Hackney

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

Circle 65 on Reader-Service Card for more information

NICKELOID IS EVERYWHERE

IN THE GAME ROOM

IN MOST ANY ROOM

IN THE KITCHEN

These eye-catching products use functionally a basic Nickeloid Metal. The finish of Chromium, Nickel, Brass or Copper is electroplated to a base metal, usually Steel (but often Zinc, Brass or Copper).

Mostly, Nickeloid Metals are supplied in continuous coils in widths up to 24" for modern, low cost fabrication. They're also available in sheets and strips. Optional: bright or satin finishes, plating one or both sides, a galaxy of stunning patterns and crimps.

Quality plating produces metals so durable they can be fabricated, even quite severely drawn or bent. Rejects minimized. For severe stamping, we offer Mar-Not protective coating that is easily peeled off after its job is done.

These handsome articles of daily use are striking indeed! Not a little of this is achieved by the functional use of bright plated Nickeloid Metals in Chrome, Brass or Copper finishes. But look again! These pictures carry a deeper, even more dramatic story . . . the story of a *new concept* of manufacture. Not always do artisans work with raw steel sheet. Not always is the final finish applied by the extra step of painting or plating. With Nickeloid Metals this finish is built-in, and it's done by a company which has dedicated itself to electroplating of sheets and coils for industry for over 60 years! The use of Nickeloid Metals as a pre-finished raw material proves the theorem that a straight line is the shortest distance between two points. Write for free Introductory Kit that unfolds the entire story and provides you with metal samples. Or, phone a Nickeloid sales office in one of the principal cities.

DESIGN ENGINEERING SHOW (BOOTH #1042) COBO HALL, DETROIT, MICH., MAY 22-25.

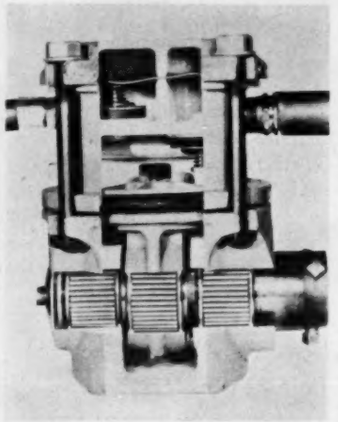
AMERICAN NICKELOID COMPANY • PERU 9, ILLINOIS

America's Pioneer Manufacturer of Pre-Finished Metals—Since 1898

MECHANICAL

Corrosive Liquid Pump 319

Pumping abrasive or corrosive liquids or slurries at moderate pressures is one application of this unit. The diaphragm-type pump reduces down-time and maintenance costs, offers quick and easy repair in field or plant, and features built-in pressure regulation. Key design of this unit completely isolates and seals off pumped liquid from contact with mechanical parts. Diaphragm material is made of either tough nylon or synthetic rubber and forms partition wall between pumping and bearing



chambers. Housing materials are available in cast iron, "Ni-Resist" or aluminum. Needle bearings, shafts and other mechanical parts are positive lubricated and run in a dust-free oil bath. Pump may be run for hours without damage if left dry. Replacement or repair in field or plant takes less than 30 minutes. Pump has a short stroke (3/16-inch) and develops 0-6 gpm at 100 psi, at 0-600 rpm; or 6-12 gpm, at 60 psi, at 600-1200 rpm.

Hydro-Dynamics Research Industries, 115 N. Cicero Ave., Chicago 44, Ill.

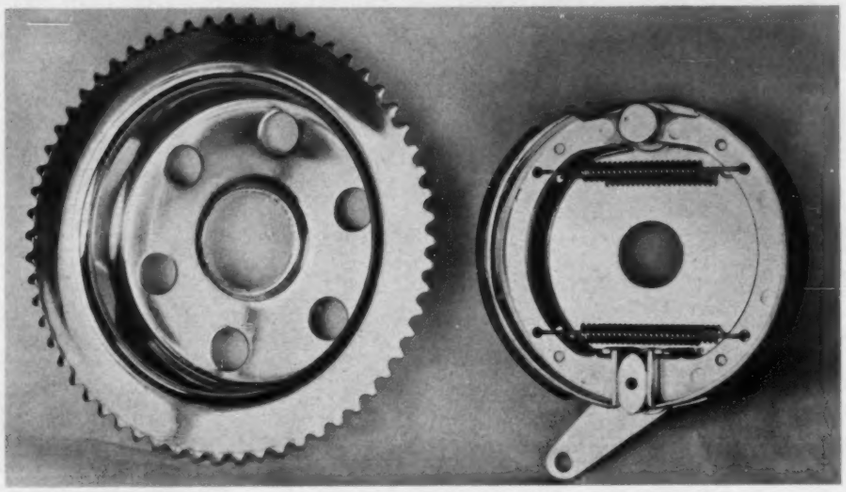
Circle 66 on Reader-Service Card

Drum-Sprocket Brake

320

A 5-inch combination drum-sprocket brake assembly is applicable on installations where space is limited between axle suspension points. Lever-actuated, internally-expanding brake mechanism is mounted on axle and remains stationary. Drum and driven sprocket are fabricated in one piece and entire piece revolves around brake mechanism. Two sizes of drum-sprockets are available—7.38 and 8.81 inches in dia. Smaller sprocket has 60 teeth and larger has 72 teeth. Both sprockets use a No. 35 chain. Application methods vary with design and construction of equipment on which brake is used. Depth of entire unit is only 1½ inches.

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.



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To Protect Threads, Tubes, Valves, Components, etc. from Dirt and Mishandling
Available from Stock

ALUMINUM		POLYETHYLENE	
Pipe Caps	"C" Series AN & SAE Fittings.	"200" Series Tapered Plug & Cap	"LT" Series Tube Caps
Pipe Plugs	"P" Series AN & SAE Fittings	"TY" Series Thick Wide Flange Tapered Plug & Cap	"600" Series Single Thread Pipe Caps
"D. O. C." Series Drive-on Caps	"C-FT" Series to all Thread Specifications	"EP" and "EE" Series Elec. Conn. Plugs & Caps	"TC" Series Self-Sealing Caps—for AN & SAE Fittings
"D.I.P." Series Drive-in Plugs	"ERA" Series for ERMETO and MS Fittings	"IF" Series Plugs for Inverted Flare Fittings	"SP" Series Flange Caps

Special Closures Manufactured to Customers' Specifications, of Aluminum or Polyethylene. Quotations on request, furnish description desired including thread size.
Manufacturers of Industrial Closures Since 1944

CLOVER INDUSTRIES, INC. 586 Young Street Tonawanda, N. Y.

Circle 68 on Reader-Service Card for more information

SOLENOID PROTECTION

with low amp. miniature CIRCUIT BREAKER

45-700.00-P

- Low cost per unit
- Prevents freezing and burnouts
- Eliminates service calls and replacements

RATED: 50 milliamps to 25 amps, 240 V a-c

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E-T-A PRODUCTS COMPANY OF AMERICA
6284 N. Cicero Ave. • Chicago 46, Ill. • Kildare 5-1553
IN CANADA: 265 Craig St. West • Montreal 1, Que.

Circle 67 on Reader-Service Card for more information

"Dyflon"®

Self-Aligning and Self-Lubricating SPHERICAL BEARINGS

Combine "Monoball"® Engineering Advantages with Life-Time Lubrication

Design engineers in many industries are specifying new "DYFLON"® SELF-ALIGNING and SELF-LUBRICATING SPHERICAL BEARINGS for these 5 major reasons:

1. **LOWER COEFFICIENT OF FRICTION** ...ideal where lubrication is impossible or undesirable.
2. **WITHSTAND EXTREME VIBRATION** ...perfect performance under shock load conditions.
3. **WILL NOT "COLD-FLOW"** ...even under extreme load conditions.
4. **IMPERVIOUS TO KNOWN CHEMICAL SOLVENTS** ...eliminates corrosion problems.
5. **FAIL-SAFE** ...due to "Monoball"® design.

Request Engineering manual No. 551.

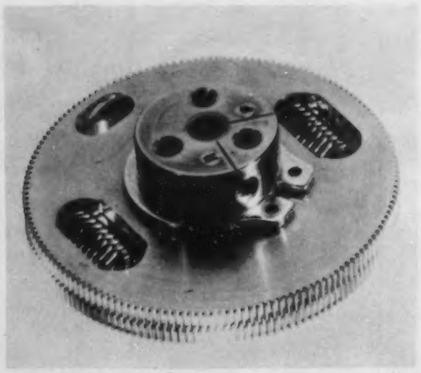
In addition, due to their two-piece "MONOBALL"® design and plastic alloy insert, "DYFLON"® bearings have a long cycle life. Alignment and installation problems are minimized. Oil-free for life means lowest possible maintenance costs.

Available in a variety of plain or rod end types. Bore sizes to 3.000". Materials include stainless steel, plastic alloys and chrome alloy steels. Ultimate static loads to 500,000 lbs.

SOUTHWEST PRODUCTS CO. 1705 SO. MOUNTAIN AVE. MONROVIA, CALIF. • PHONE: MURRAY 1-9616

Circle 69 on Reader-Service Card for more information

Antibacklash Gear 321



Offered in varieties of stainless steel, this gearing unit is of two-piece construction, spring-loaded to eliminate backlash in the mechanism. Both pieces of gear are cut and machined together so that when final assembly takes place, gear is accurate in tooth form and spacing. Two teeth are offset to insure a controlled anti-backlash pressure, and tension is measured and controlled by an instrument-type torque gage. Gear offers high accuracy in bore and in set between main gear and plate gear. Diameter and concentricities are held to 0.002-inch tolerances and gear conforms to AGMA Precision Class 3. Diametral pitch is 96 or 120.

Roi Gears, Inc., a subsidiary of Rogers & Oling, Inc., 2670 E. Walnut St., Pasadena, Calif.

Aluminum Unions 322

All-aluminum, explosion-proof unions feature small exterior dimensions in two models. Series EUM unions have a male end and a female end; series EUF unions have female ends. Body and ring are tapered to provide a positive seal if an interior explosion occurs. UL and CSA approvals have been obtained. Unions are particularly useful in places where space is limited. Sizes are provided to handle ½ through 2-inch conduit. Threads are clean and locking sleeve is knurled to provide a sure wrench grip.

Killark Electric Mfg. Co., 3940 Easton Ave., St. Louis 13, Mo.

Designers think of R/M first for asbestos, rubber,

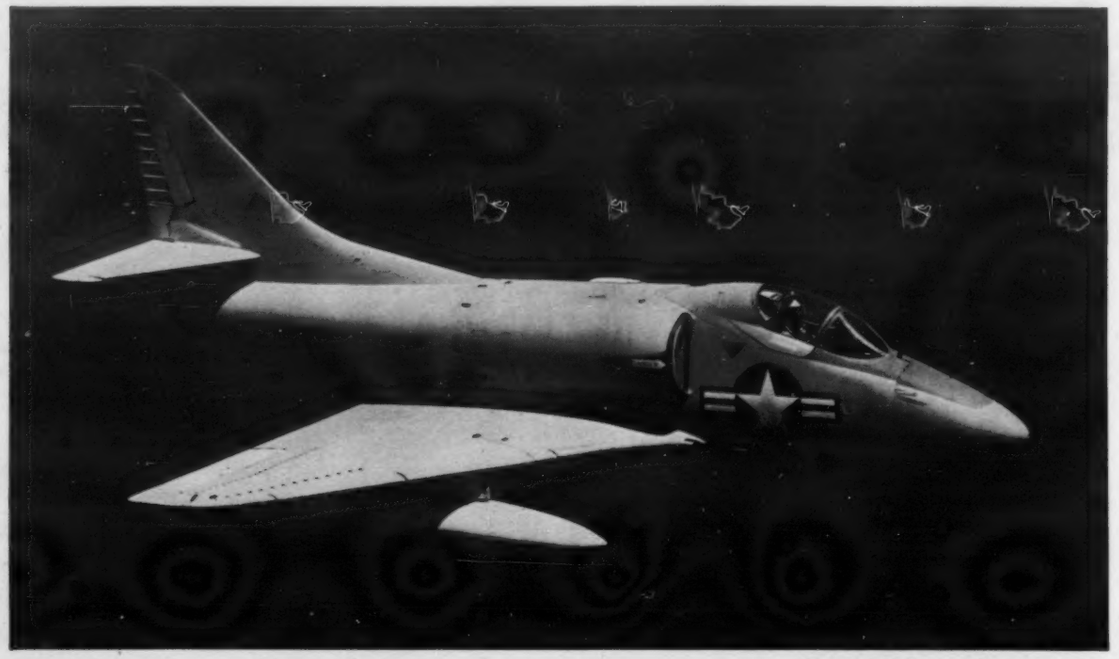


Photo courtesy Douglas Aircraft Company, Inc.

Bonded, rivetless, aluminum-cored structure of the Douglas A4D Skyhawk's rudder section prevents skin-crack failures. Conventional riveted structure could not stand pre-service load and vibration tests. Sonic flight vibration would have caused cracks between rivets on skin.

11 Ways Ray-BOND® Adhesives Solve Tough Fastening Problems

New bonding and laminating techniques at R/M help solve difficult fastening problems and thereby make possible many of the new products being developed and produced by America's advancing technology.

The advantages of Ray-BOND Adhesives include:

Rivets can be eliminated • Members too thin to rivet can be joined and fixed • Manufacturing costs are reduced • Life of wearing surfaces is extended • Heat conductivity is improved • Weight reduction is substantial • Load is uniformly distributed over joint area • Bond produces residual elasticity • Complex shapes can be easily fabricated • Electrical non-conductivity and protection against corrosion can be achieved • Methods of application are fast, economical, flexible

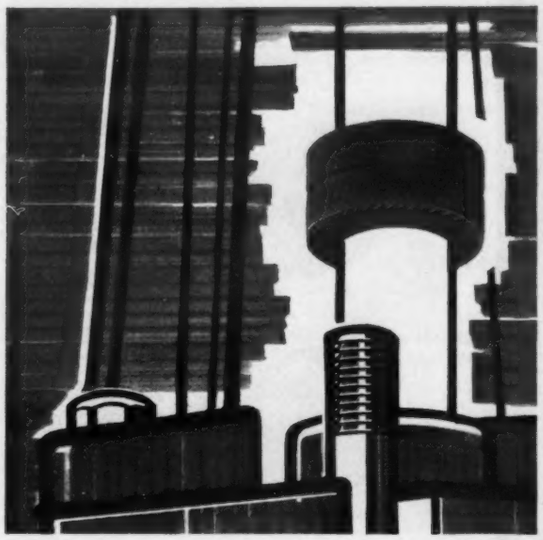
Counsel and detailed technical information regarding the selection and application of adhesives are freely available to you from Raybestos-Manhattan. An R/M representative can call on you promptly to discuss your requirements.

ADHESIVES

Get helpful engineering information on selecting, bonding and testing adhesives. Write today for your free copy of Bulletin No. 701. Adhesives Department, Raybestos-Manhattan, Inc., Bridgeport, Conn.

Circle 96 for more information on Adhesives

. sintered metal, and engineered plastic products



R/M CAPABILITY PRODUCES VALVE STEM PACKING

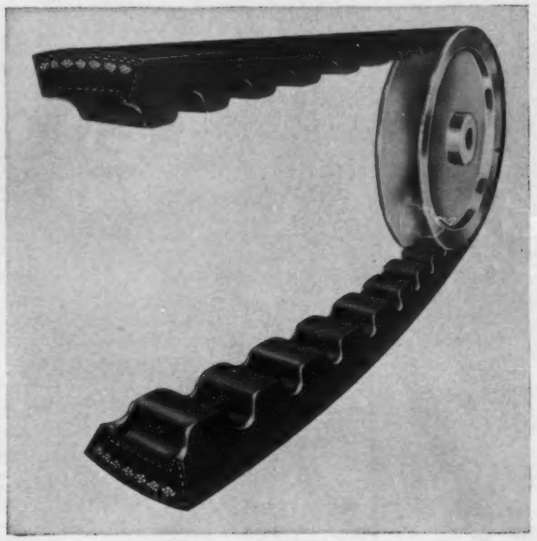
of low volume loss at up to 1150°F

Low volume loss is a basic requirement of high-temperature valve stem packings. Reliable sealing characteristics are assured when valves are packed with R/M No. 325 because total volume loss is *less than 5%*. R/M No. 325 high-temperature valve stem packing is free of the organic materials that make other packings burn out and require much adjustment. Contains AAA grade Inconel-wire-inserted asbestos yarns braided over a plastic core that will not fuse. R/M No. 325 offers an extra dividend in that it contains a corrosion-resistant inhibitor that protects against valve stem pitting after valves are hydrostatically tested and stored.

There are R/M valve stem packings for your every department, each offering superior advantages. Let us know your requirements and depend on us to meet them.

PACKINGS

For complete information on R/M Mechanical Packings and Gasket Materials, write for new Catalog P-100. Packing Division, Raybestos-Manhattan, Inc., Passaic, N.J.



R/M CX MOLDED V-BELT OUTLASTS—AND OUTPERFORMS OTHER BELTS 8 to 1 . . .

Use R/M CX Molded V-Belts wherever more flexibility and ruggedness with quieter, cooler vibration-free operation are required.

- **Fully Molded—Fully Jacketed**
- **No Cut Notches—No Exposed Sides**
- **Holds Shape and Effective Length Without Stretch**
- **Vibration-Free—No Slap, No Hum, No Buzz**
- **No Ply Separation—No Flex-Cracking**
- **Ideal for Small Sheave Diameters, Short Centers, High Speeds**

It's the only notched V-belt of its kind made. Let R/M specialists work with you on V-belts, rubber hose, transmission or conveyor belting, molded or extruded parts.

RUBBER

Write today for Bulletin M220 and booklet shown: full details on a wide variety of industrial rubber products. Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N.J.

RAYBESTOS-MANHATTAN, INC.

FACTORIES: Passaic, N.J. • Bridgeport, Conn. • Manheim, Pa. • Paramount, Calif. • No. Charleston, S.C.
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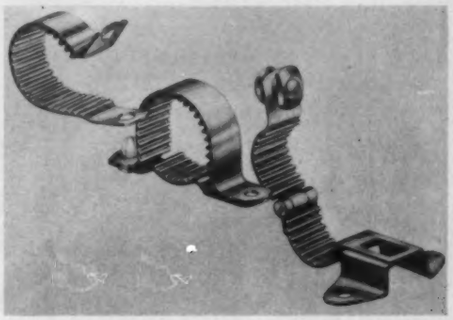
Circle 97 for more information on Packings

Circle 98 for more information on Rubber

Cushion Clamps 323



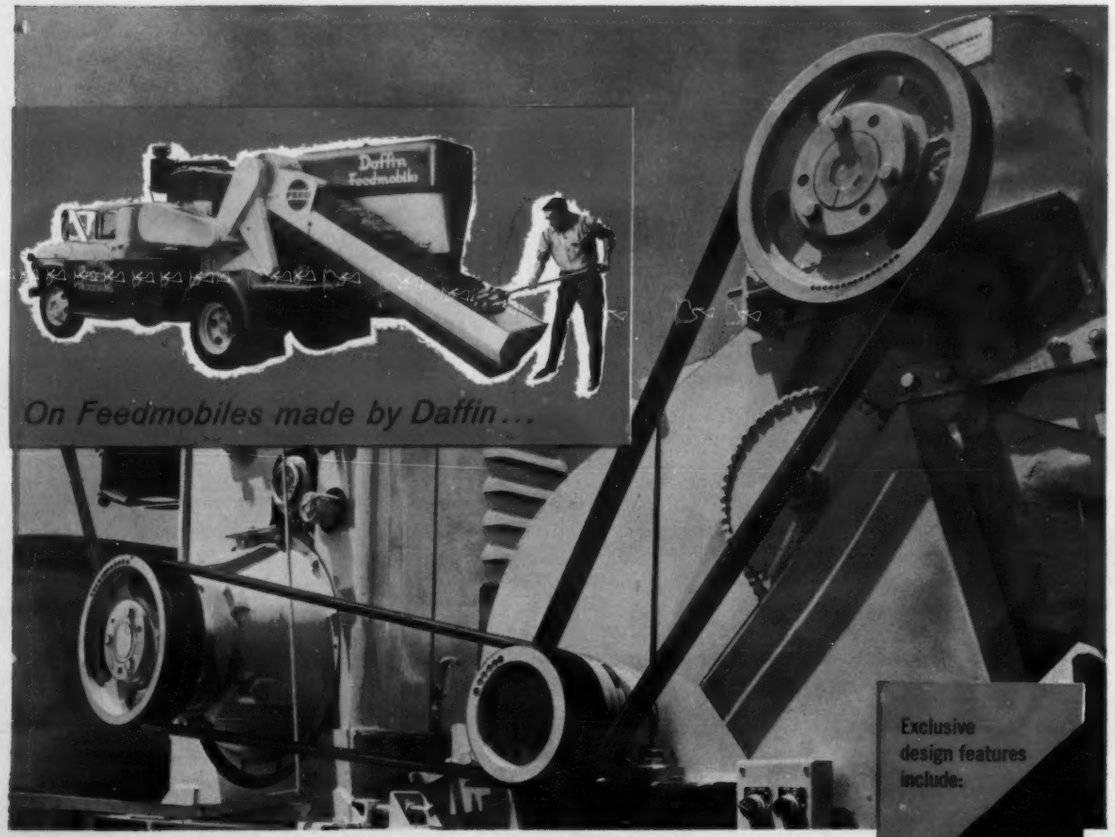
Temperatures as high as 1500F are resisted by lightweight cushion clamps. Clamp and cushion are made entirely of type 321 stainless steel, per specification MIL-8-6721. Cushion is corrugated to furnish a spring action for high-frequency, low-amplitude vibration. The TA-1500 series is offered in a size range from ¼ to 4 inches ID. Unit is interchangeable with any standard ½-inch AN, MS or commercial-type cushioned loop clamps. Cushioning is spot-welded to clamp and cushion edges are crimped for abrasion-free grip.

TA Mfg. Corp., 4607 Alger St., Los Angeles 39, Calif.

High-Torque Size 5 Servo 324

A small, size 5, precision servomotor is capable of meeting military environmental specifications operating continuously at —55 to 125C. Type 5351-01 has 0.12 oz-in torque at stall and 47,000 rad/sec² torque-to-inertia ratio. The device has a no-load speed of 9500 rpm minimum; rotor moment of inertia is 0.18 g-cm²; time constant is 0.020 sec and reversing time is 0.034 sec. Rated voltage at 400 cps is 26v, average input current at stall is 0.08 amp, average input power at stall is 1.7w. Corrosion-resistant materials are used throughout the small rotary component.

John Oster Mfg. Co., Avionic Div., Racine, Wis.



Gates Super HC Drives permit power increase of 20hp in less drive space

The Daffin Feedmobile is a well-designed, efficient feed mill on wheels made by Daffin Manufacturing Co. of Lancaster, Pennsylvania. Originally, all the power for grinding, mixing and blending was transmitted by conventional V-belt drives.

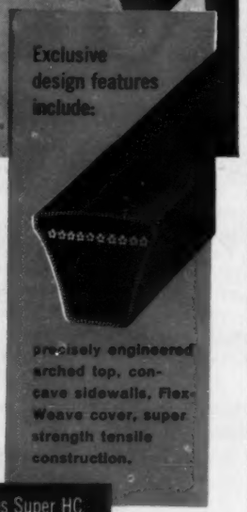
Early in 1960, the machine was redesigned to obtain the competitive advantages that result through use of Gates Super HC High Capacity V-Belt Drives.

An official of the company, John Skinner, Jr., says: "The Gates Super HC Drives let us increase the output of the diesel power plant from about 100 HP to 120 HP without reducing the original safety factor. Sheaves are narrower and are about 80 pounds lighter, reducing the overhang load on bearings, increasing bearing life. Guards are 4 inches narrower, require less metal and are nearly 33% lighter weight. Drive cost for each machine has been cut 7 or 8%."

He says further: "The Gates High Capacity Drives have greatly strengthened one of our most important selling points—the fact that 'there is far less down-time with a Daffin.'"

Manufacturers everywhere have standardized upon the Gates Super HC V-Belt Drive—the first and most advanced high capacity drive. It is your best assurance that your power transmission unit will not soon become obsolete.

The Gates Fieldman located near you is a drive design expert. Contact him for technical information and assistance in designing Gates High Capacity V-Belt Drives.

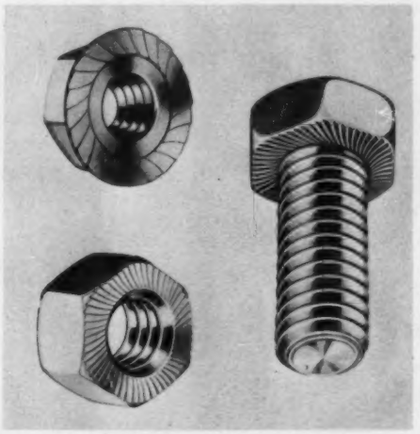

Exclusive design features include:
precisely engineered arched top, concave sidewalls, Flex-Weave cover, super strength tensile construction.

The Gates Rubber Company, Denver, Colorado BP 150

Gates Super HC V-Belt Drives

Circle 74 on Reader-Service Card for more information

Self-Locking Fasteners 325



When a designer needs a fastener that demands uniform tension throughout an assembly, he should consider the "M-F Whiz-Locks". These nuts offer dependability of high-grade locknuts, together with easy spin-on application of the common nut (the manufacturer states). Bearing face of both nut and screw is a series of spiral serrations on a convex base that takes a firm grip when nut is tightened. It can require up to 50 percent more effort to remove a "Whiz-Lock" than is needed to apply it. Fasteners are available for oversized holes where bearing surface is limited.

MacLean-Fogg Lock Nut Co., 5535 N. Wolcott Ave., Chicago 40, Ill.

Flow-Regulating Valves 326

Pneumatic and hydraulic flow-regulating valves provide fine adjustment in low flow range. Flow increases from zero to about 10 percent of potential during first 360-deg rotation of valve-adjusting sleeve. Successive rotations of sleeve produce flow volumes of approximately 30, 65 and 100 percent. This unit is offered in ⅛-, ¼-, ⅜- and ½-inch pipe sizes. Valve effectively operates in a temperature range from —40 to 250F. Unit accommodates working air pressure to 250 psi and oil pressure to 1000 psi. The "Dyna-Trol" functions without use of internal springs and is rustproof.

Mead Fluid Dynamics Div., Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.

Use it as an axle... SEL-LOK spring pin

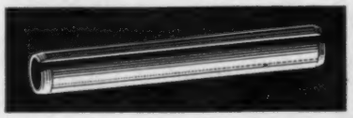
In cigarette lighter

On pulley

In flow rate integrator

- Swift fastening—just drill and drive
- Secure locking—won't work loose despite shock or vibration
- Eliminates costly tapping, reaming, peening, milling
- Can be reused repeatedly
- 101 uses—as keys, cotter pins, axles, hinge pins, wrist pins, stop pins, pivots, etc.

SEL-LOK spring pins are available in carbon and corrosion-resistant steel (from 1/16 x 3/16 through 1/2 x 4 in.) and beryllium copper (1/16 x 3/16 through 1/4 x 3 1/2 in.). See your SPS distributor or write for Bulletin 2670.



INDUSTRIAL FASTENER Division **sps**

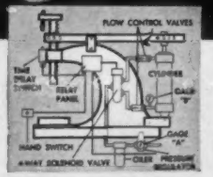
JENKINTOWN 6, PENNSYLVANIA

Circle 75 on Reader-Service Card for more information

PNEU-TROL

AUTOMATION TIME DELAY SWITCH

FOR CONTROLLED TIME DWELL OF AIR OR HYDRAULIC CYLINDERS



Arbor press converted to high production power press, using double end cylinder, Time Delay Switch, Flow Control Valves, and related equipment. Flow Valves permit independent ram speed adjustment in both directions. Differential pressure between "A" and "B" gages caused by throttling effect of Flow Control Valve creates time interval in working pressure build-up, which is compensated for by Time Delay Switch setting. This insures consistently accurate working pressure on the ram.

- Holds dwell accurately to fraction of second
- Automatically re-sets
- Designed for millions of actuations

Pneu-Trol Time Delay Switch will hold any cylinder controlled motion or operation at a positive stop on either end of the stroke for 1/4 to 60 seconds in 20 to 1 ratios. Simple, easy to adjust. Automatically re-sets after each actuation. Positive, controlled time dwell permits wider use of air or hydraulic power in automatic operations, increases accuracy of work by insuring split-second accuracy of time dwell. Available with many thrust linkages for left and right, down, up, or horizontal thrust. Write for Special Bulletin TDS-59

AUTOMATION AUTO-PONENTS INC COMPONENTS

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BELLWOOD (Chicago Suburb) ILLINOIS

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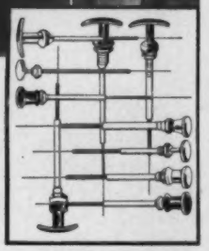
Specify **CLUM PUSH-PULL CONTROLS**

Quality-Designed for Long Life Efficiency and Dependability



LOCK TYPE, RATCHET TYPE, HEATER AND DEFROSTER TYPE

Choose from a wide range of Advanced-Types. Expertly engineered in stainless steel, galvanized, or plastic tubing. Cast, stamped, aluminum or tenite knobs — durably plated in chrome, zinc, nickel or enamels.

Available as "Standards" or built to your specifications.

WRITE TODAY . . . for complete engineering data and selection information contained in catalog.

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CLUM MANUFACTURING COMPANY
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GEARMOTORS

6 Basic Sizes

- SPEED UP TO 200 RPM
- POWER UP TO 40 IN. LB.
- OPEN OR ENCLOSED CASE
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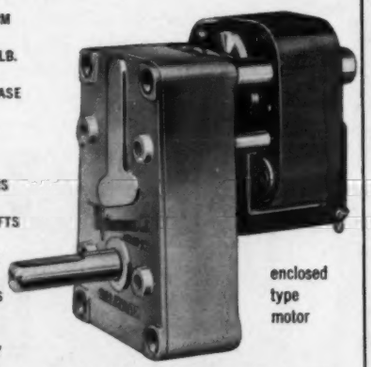

enclosed type motor

MILLIONS OF MOTORESEARCH GEARMOTORS NOW IN USE! Motoresearch also designs and produces high frequency motors, generators, rectifier type power supplies and other Special Electrical Equipment. We invite your inquiries.

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RACINE, WISCONSIN
Designers and Manufacturers of
special electrical equipment

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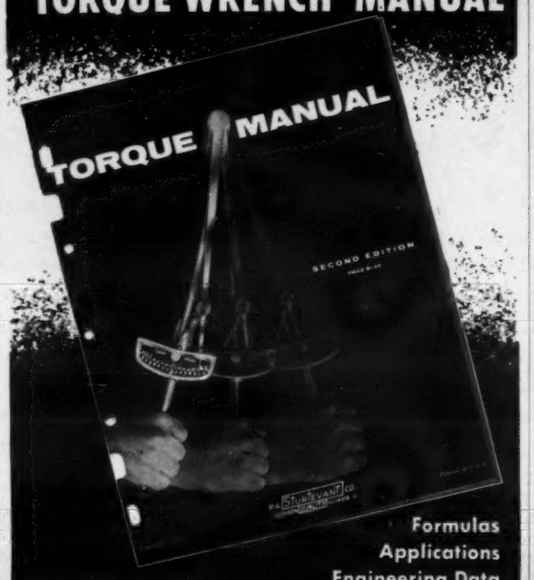
"TORQUE WRENCH" MANUAL



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Formulas
Applications
Engineering Data
Screw Torque Data
Adapter Problems
General Principles

P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

Manufacturers of over 85% of the torque wrenches used in industry

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TRU-SEAL

TEFLON SEAL

Saves hours in piping installations

PAT. PENDING

Eliminates leaks in oil, air, water, vacuum, chemical lines

Tru-Seal saves hours in assembling piping installations because it enables you to run your pipe lines in any direction you wish, quickly and easily—without having to recut and re-thread piping sections. Wherever used on air, oil, water, steam, vacuum or chemical lines, it seals perfectly at —100° F. to plus 500° F.—*without the use of pipe dope.* Its installation requires only light tightening torque, thus eliminating over-tightening damage to valves, pumps, compressors, and other fittings.

For further information write

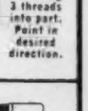
TRU-SEAL DIVISION
FLICK-REEDY CORPORATION
7NO20 York Rd., Bensenville, Ill.

"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.

1. Thread Tru-Seal on pipe or fitting as far as it will go hand tight. SEAL SIDE

2. Thread pipe or fitting 3 threads into part. Point in desired direction.

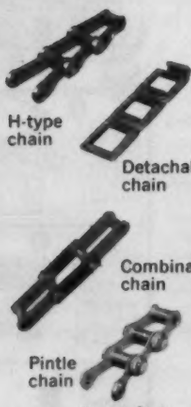
3. Tighten Tru-Seal to complete leakproof assembly (only light torque required).



Circle 80 on Reader-Service Card for more information

You get MORE when you...

call your Moline Chain Distributor



GET THE "EXTRA SERVICES" and save your precious time by calling your local Moline Chain distributor when you need chain for conveying, elevating and power transmission.

Your Moline Chain distributor offers much more than just a source of supply. His is a "local service business"—and he has the engineering experience and know-how to help solve your problems. He has also a crew of technical men—machinists, gear cutters, installation and maintenance men—to give you special service. And he carries a tremendous stock—as many as 7000 items—virtually any item needed for efficient power transmission.

You can depend upon *fast service* too, so call your Moline Chain distributor today!

Moline Chains

Specializing in the manufacture of chains

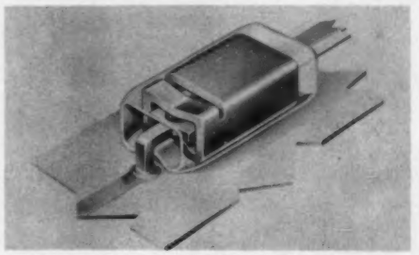
Leaders for 60 years

for conveying, elevating and power transmission

MOLINE MALLEABLE IRON CO., St. Charles, Illinois

Circle 81 on Reader-Service Card for more information

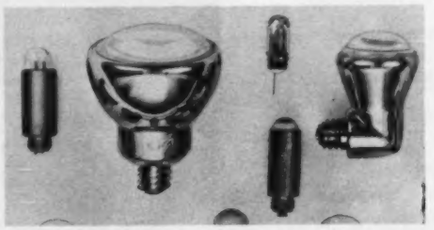
Solder-Tab Terminal 327



A simple terminator, the "Flex-Term", is designed to end the preliminary preparation (scraping, abrasing or heating) normally required to terminate flexible copper conductive tape or custom-printed copper-oxide tape. Choice of basic configurations of terminals provides a rapid and reliable means to connect tape to printed-circuit boards, pin or two-piece socket connectors and to barrier or terminal strips. Design is adaptable to customer requirements. Terminal sleeve is soft annealed copper, the tab is beryllium copper, while insulation is natural-colored "Teflon" tubing. Metal surfaces are gold plated. Evaluation tests for pull and heat cycling to practical limits of tape insulation material indicate that contact resistance of terminal is less than one milliohm. Visual inspection determines correct assembly.

Hi-Shear Corp., 2600 W. 247th St., Torrance, Calif.

Miniature Lamps 328



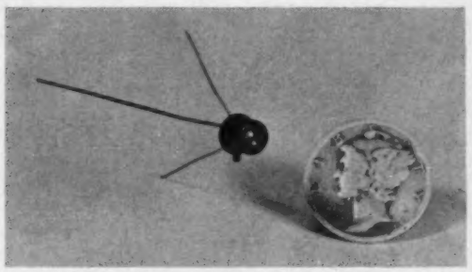
Industrial and technical applications requiring special lamps in odd shapes and sizes will benefit from this line of more than 14 different lamp in-stock styles and special styles for specific customer needs. Lamps are said to be brilliant and durable with projected beams of light free from filament shadows or other aberrations.

Welch Allyn, Inc., 168 Jordan Rd., Skaneateles Falls, N. Y.

Photocells 329

The "Photran" is an efficient, light-actuated, PNPN, silicon switch, having a high impedance (over 10 megohms) when "off" and a low impedance (under 10 ohms) when triggered "on" by light. Its output is determined primarily by load and is independent of light input at all intensities above triggering level. Although it is miniature in size (0.185 inch in dia by 0.200 inch long), the unit can deliver up to 300 ma load current at up to 200v with an efficiency exceeding 98 percent. Applications include counting, sorting, power control, limit switching, programming and optical logic control.

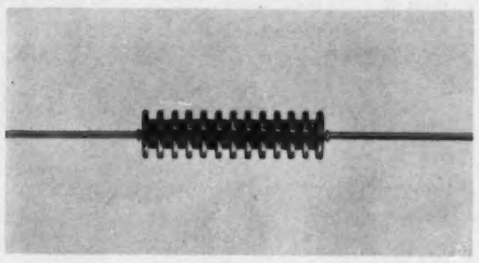
Solid State Products, Inc., One Pingree St., Salem, Mass.



High-Frequency Resistors 370

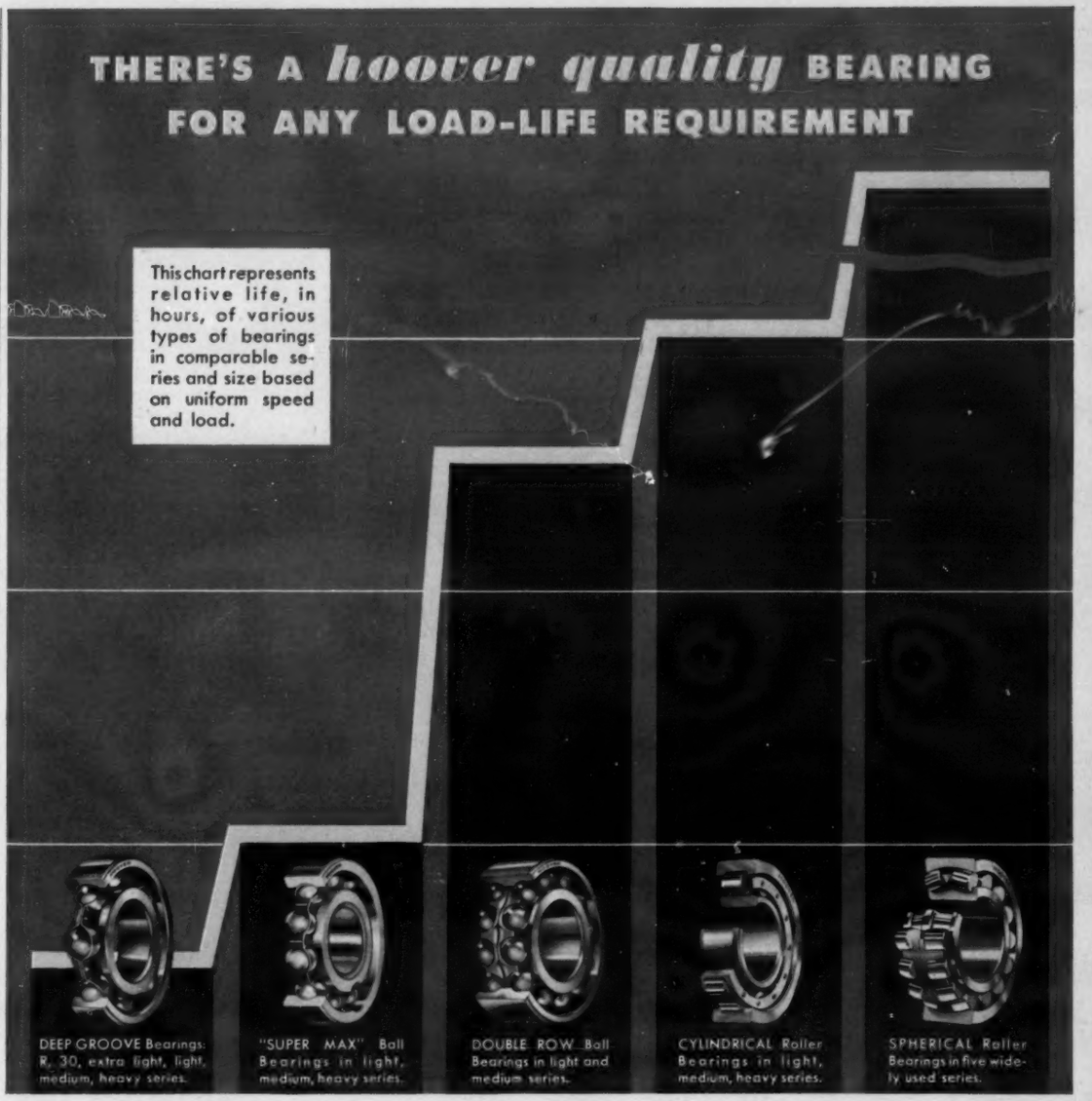
High-frequency resistor units can be manufactured with resistance values as high as one megohm. Resistors are guaranteed to an accuracy of 0.005 percent. Additionally, all units in the new line exhibit a rise time of less than 0.2 microsec and a capacitance of less than 0.1 MMF. Key factors in the elimination of inductive and capacitive effects in the units are use of equal-layer winding techniques to give small voltage gradients which reduce capacitance, and use of pi windings which alternately sets up reverse current flow between adjacent pi sections canceling out adjacent magnetic fields.

Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y.



THERE'S A *hoover quality* BEARING FOR ANY LOAD-LIFE REQUIREMENT

This chart represents relative life, in hours, of various types of bearings in comparable series and size based on uniform speed and load.



DEEP GROOVE Bearings: R, 30, extra light, light, medium, heavy series.

"SUPER MAX" Ball Bearings in light, medium, heavy series.

DOUBLE ROW Ball Bearings in light and medium series.

CYLINDRICAL Roller Bearings in light, medium, heavy series.

SPHERICAL Roller Bearings in five widely used series.

Hoover's exceptionally wide range of bearing types provides performance characteristics needed for practically any application . . . from high speed intermittent duty to prolonged life under heavy, constant load conditions.

Sizes range from tiny 3/8" outside diameter R Series to giant 36" spherical roller bearings. Most types are available with snap rings, shields, seals or shield and seal combinations.

Outstanding *Hoover Quality* . . . *Micro-Velvet* balls and *Hoover Honed* raceways in ball bearings, *Super Finish* raceways and rollers in roller bearings, plus other exclusive features . . . assure superior performance. For information contact your Hoover bearing specialist or mail the coupon to us.

Micro-Velvet, Hoover Honed and "Super Max" are Hoover Trademarks.

hoover
BALL AND BEARING COMPANY
5400 South State Road, Ann Arbor, Michigan
Zone Sales Offices and Warehouses | 8581 South Chicago Ave., Chicago 17, Illinois
290 Lodi Street, Hackensack, New Jersey
2020 South Figueroa, Los Angeles 7, California

Hoover Ball and Bearing Company DN-4
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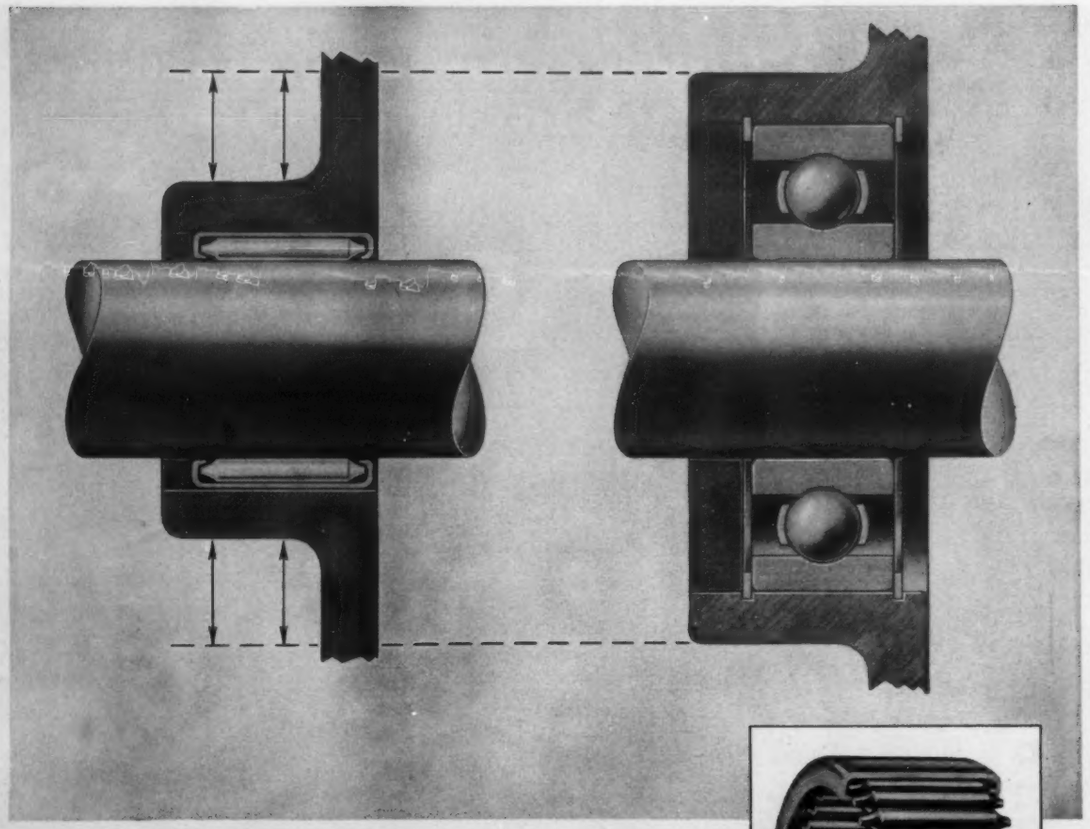
Please send information on the following Hoover bearings:
Deep Groove ☐ "Super Max" ☐ Double Row ☐
Cylindrical Roller ☐ Spherical Roller ☐
Have Sales Representative Call ☐
Name
Title
Company
Address
City Zone State

Circle 82 on Reader-Service Card for more information

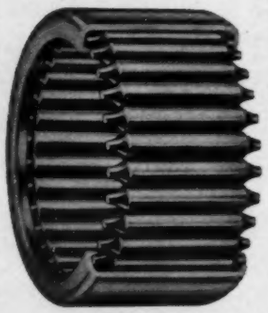


Designed for Compactness... Torrington Needle Bearings

Simpler, more compact design is possible wherever Torrington Needle Bearings are put to work in eliminating friction problems.

These outstanding bearings offer a higher radial load capacity than any other bearing of comparable size. They are more compact, lighter in weight, and are lower in unit cost. The full complement of small-diameter precision rollers insures exceptional antifriction performance and long, maintenance-free service life. The turned-in lips on the outer shell guarantee positive roller retention. Installation and assembly are fast, simple, economical.

The unmatched design and production advantages of Torrington Needle Bearings have been proved in applications ranging from office machines to automobiles, washing machines to earth-moving machinery. Give *your* product the benefit of our antifriction know-how. Write or call Torrington—maker of every basic type of antifriction bearing.



TORRINGTON NEEDLE BEARINGS FEATURE:

- Full complement of retained rollers
- Unequalled radial load capacity
- Low coefficient of starting and running friction
- Low unit cost
- Long service life
- Compactness and light weight
- Run directly on hardened shafts
- Permit use of larger and stiffer shafts

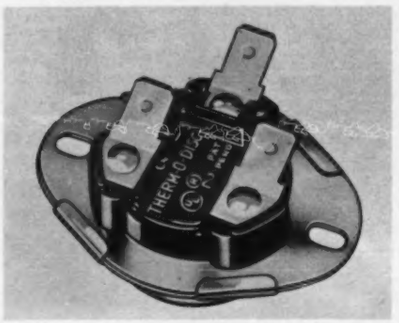
progress through precision **TORRINGTON BEARINGS**

THE TORRINGTON COMPANY Torrington, Conn. • South Bend 21, Indiana

Circle 83 on Reader-Service Card for more information

ELECTRICAL

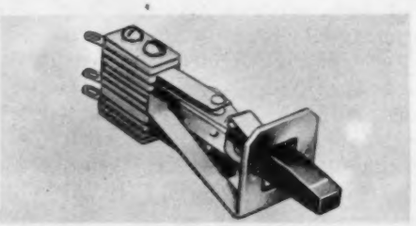
Bimetal-Disc Thermostat 330



The type 11T, SPST or SPDT thermostat can now be supplied with a differential which will not exceed 8F. The range of calibrations presently available is between 125 and 180F. Temperature calibration is factory preset and nonadjustable. The unit is UL listed at 25 amp resistive or 1 hp inductive, at 120/240v a-c. Choice of terminals is offered, including inclined blade, vertical blade and screw terminals.

Therm-O-Disc, Inc., Mansfield, Ohio.

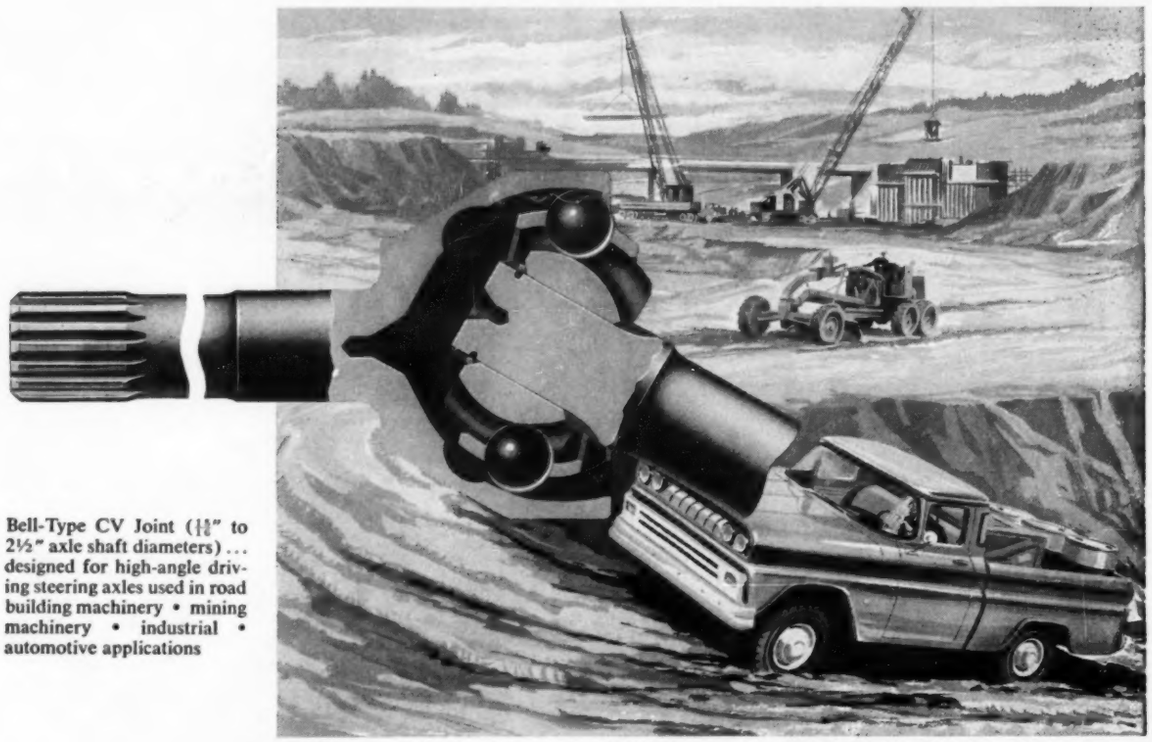
Toggle Switch 331



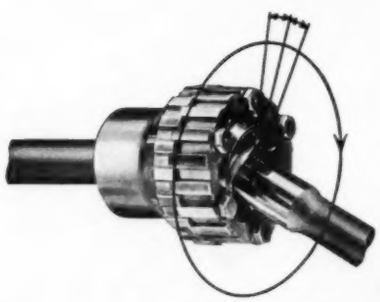
A new concept in toggle-switch design for general use in all types of electronic equipment features long life, reliability, dependability and quality of leaf switches. The "Tini-Toggle" switches, series 23000, provide long "spring-action" life, accomplished by use of relatively long springs without any "forms" at point of flexing. Switches offer these innovations: multiplicity of circuits; three-position, toggle-type switch or two-position switch with momentary or locking action; choice of contacts, fine silver rated at 3 amp, 120v a-c noninductive load (300v maximum); or Palladium contacts. The rugged switch frame has four tapped screw holes for convenience of panel mounting.

Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.

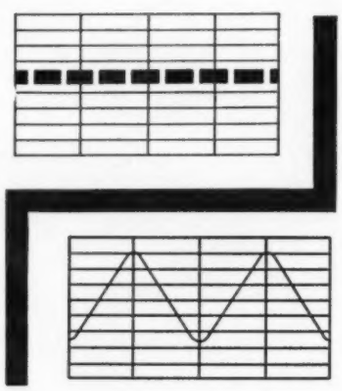
CON-VEL (RZEPPA) CV Universal Joints Give Longer Life, Higher Torque Capacity!

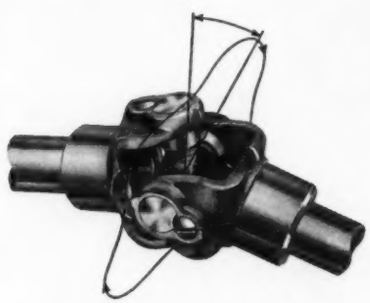


Bell-Type CV Joint ($\frac{1}{16}$" to 2½" axle shaft diameters) . . . designed for high-angle driving steering axles used in road building machinery • mining machinery • industrial • automotive applications



Disc-Type CV Joint (from 2⅛" to 16¼" swing diameter) . . . designed for all types of industrial drive applications. Rzeppa Joints always transmit torque smoothly, even at unbalanced angles. Note constant velocity of 100% for Rzeppa Joint.





During rotation at a given angle, pin or slipper-type joints speed up, slow down twice during one revolution, as shown by the solid line in the graph.

DANA Con-vel

CON-VEL DIVISION

DANA CORPORATION

3901 Christopher
Detroit 11, Michigan

WRITE
for your free copy of this new engineering data folder on the complete line of Rzeppa constant velocity joints.

Circle 84 on Reader-Service Card for more information

Tool and Hardware Manufacturers Use Malleable for the Parts They Guarantee...

"Guaranteed Against Warping or Breaking" is the seal of quality often found on tools and hardware made of Malleable iron. Frequently Malleable components are guaranteed while the other materials in the same tools are not.

Proven performance superiority has induced many tool and hardware manufacturers to switch to Malleable castings so they, too, can guarantee their products. At the same time, they often reduce their costs. How? Because Malleable provides more strength per dollar than any other metal; Malleable is the most machinable of all ferrous metals of similar properties; Malleable is truly outstanding for its toughness, ductility, castability and corrosion resistance. While Malleable's natural appearance is attractive, a wide variety of finishes can be applied for added customer appeal.

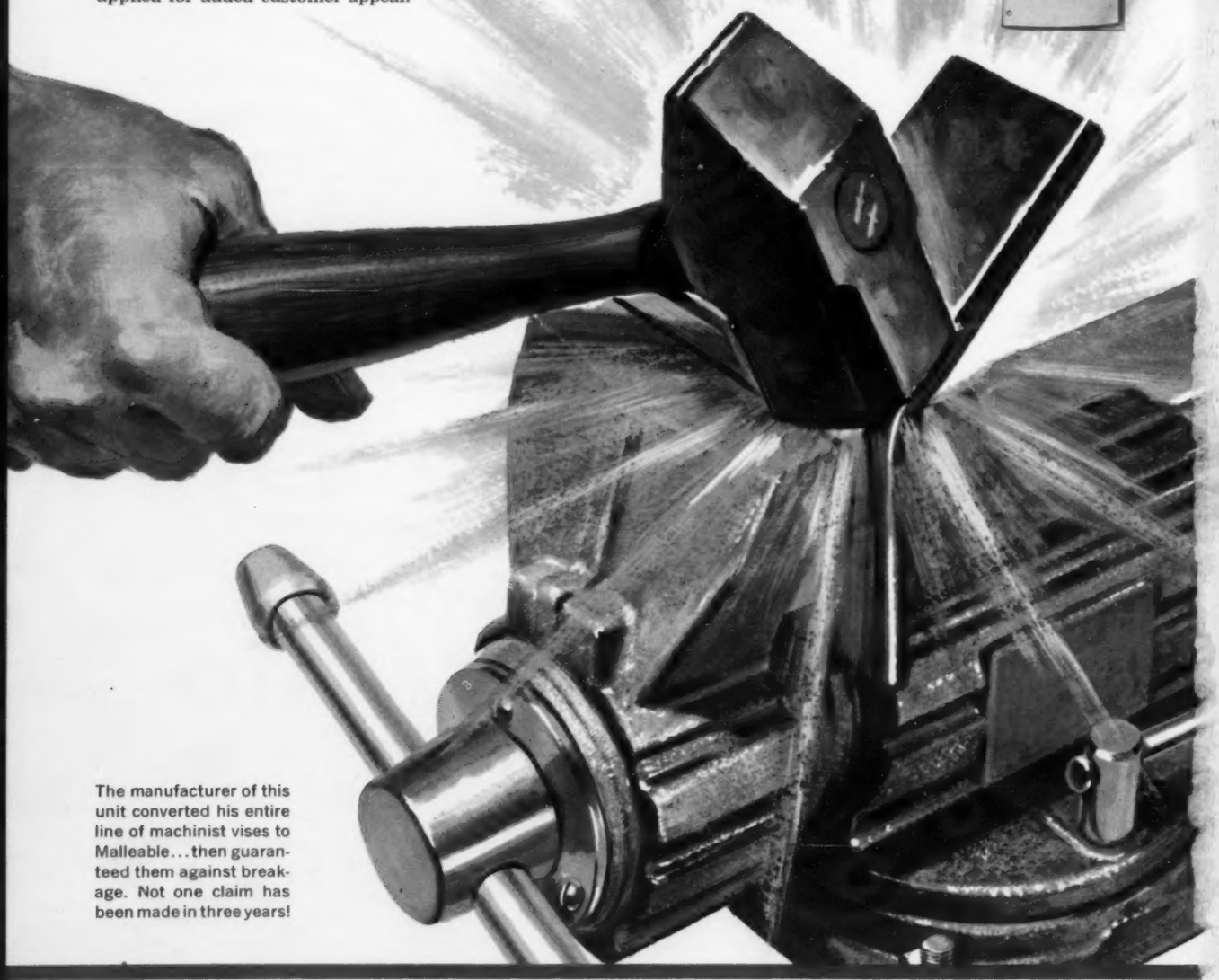
Improve your products by using Malleable castings. Check with any Malleable producer that displays this symbol —

MEMBER

MALLEABLE

CASTINGS COUNCIL

Profitmaking Ideas are yours free in our Data Unit No. 114, available from any member foundry, or Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.

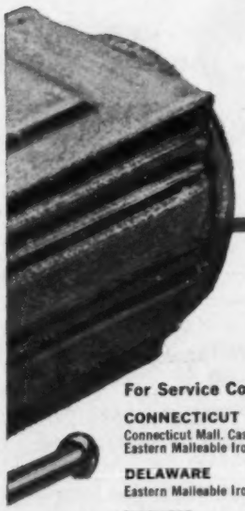


The manufacturer of this unit converted his entire line of machinist vises to Malleable... then guaranteed them against breakage. Not one claim has been made in three years!

$10,000 per year are saved by the manufacturer of this hydraulic jack since he converted the 16 inch long caster bar to a Malleable casting. The bar originally was a fabricated part that required shearing, punching, sawing, chipping, grinding and reaming, plus welding at eight points. The Malleable casting is delivered ready-to-use at a savings of $2.68 per unit.

The wide range of Malleable's properties permits its use in hundreds of tool and hardware applications. Besides the examples shown here, Malleable is used for load binders, chain hoists, hinges, many kinds of clamps, pliers, trailer hitches, jack screws, gun frames, fence fittings, casters, brackets and pipe threading and cutting tools.

When you're interested in high quality and long life, Malleable gives your products many competitive advantages. We'll be glad to show you how. Write or call one of the companies listed below.



For Quality and Economy...Use MALLEABLE

For Service Contact...

CONNECTICUT
Connecticut Mall. Castings Co., New Haven 6
Eastern Malleable Iron Co., Naugatuck

DELAWARE
Eastern Malleable Iron Co., Wilmington 99

ILLINOIS
Central Fdry. Div., Gen. Motors, Danville
Chicago Malleable Castings Co., Chicago 43
Moline Iron Works, Moline
Moline Malleable Iron Co., St. Charles
National Mall. and Steel Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

INDIANA
Albion Malleable Iron Company, Muncie Division, Muncie
Link-Belt Company, Indianapolis 6
National Mall. & Steel Castings Co., Indianapolis 22

IOWA
Iowa Malleable Iron Co., Fairfield

MASSACHUSETTS
Belcher Malleable Iron Co., Easton

MICHIGAN
Albion Malleable Iron Co., Albion
Auto Specialties Mfg. Co., Saint Joseph
Cadillac Malleable Iron Co., Cadillac
Central Fdry. Div., Gen. Motors, Saginaw

MINNESOTA
Northern Malleable Iron Co., St. Paul 6

MISSISSIPPI
Mississippi Malleable Iron Co., Meridian

NEW HAMPSHIRE
Laconia Malleable Iron Co., Laconia

NEW YORK
Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

OHIO
American Malleable Castings Co., Marion
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
National Mall. and Steel Castings Co., Cleveland 6

PENNSYLVANIA
Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

TEXAS
Texas Foundries, Inc., Lufkin

WEST VIRGINIA
West Virginia Mall. Iron Co., Point Pleasant

WISCONSIN
Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
Federal Malleable Company, Inc., West Allis 14
Kirsh Foundry Inc., Beaver Dam
Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46

Circle 85 on Reader-Service Card for more information

Printed Board Connector 332

A device for connecting flat conductor cable to printed-circuit boards or to flexible etched circuitry produces a direct conductor-to-conductor contact without solder. Elimination of crimped and soldered joints permits an appreciable reduction of installation time, affording a high order of reliability. A continuous one-piece spring locks cable into connector. It provides a pressure point at each conductor contact. The "Pos-E-Kon" device can be used to set up test points at any position on flat conductor cable. It also can be used to connect flat conductor cable to flat conductor cable without cutting conductors.

Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.

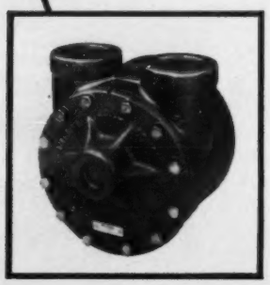
Miniature D-C Relay 333

The MK series d-c relay, unenclosed, occupies less than ½ cu in of space. Terminal arrangements for enclosed types are octal plug and solder hook. Beryllium copper hinges assure stable performance and long life. Specifications include: contact arrangement, SPDT and DPDT; contact rating, 1 amp resistive, 0.6 amp inductive and 26.5v d-c or 115v a-c; duty cycle, continuous; temperature range (when specified), —55 to 85C. Dimensions for the unenclosed model are 51/64 inch high by 31/32 inch long by ⅝ inch wide.

Elgin Advance Relays, Electronics Div., Elgin National Watch Co., 2435 N. Naomi St., Burbank, Calif.

Another TUTHILL Application

TUTHILL PUMPS Lubricate GARDNER-DENVER'S RP-900 Compressor



Gardner-Denver describes its new model RP-900 as "the finest rotary compressors on the market". Developed for operation under the most extreme climatic conditions the new units are designed to provide the greatest possible dependability in the roughest service.

Essential to the RP-900's dependable performance is its lubricating oil pump. Gardner-Denver selected Tuthill to work with its engineers in developing a unit which would provide positive and metered oil-flow to assure lubrication, cooling and sealing under all operating conditions.

Tuthill's standard pump 5C, especially modified to meet the demands of this particular application, was selected. Adapted for operation at 1800 rpm, the Tuthill unit is mounted directly on the compressor rotor shaft. Special mounting brackets and shafts, developed by Tuthill's engineers, facilitate assembly and maintenance of the compressor.

800 Standard Models

The model 5C, modified for use by Gardner-Denver, is only one of over 800 standard models in Tuthill's complete line . . . providing a complete selection for a wide variety of requirements in lubrication, hydraulic, coolant, refrigeration, air conditioning, and many other services.

Very probably a Tuthill model will supply an economical, dependable answer to your pumping problem. For special applications, Tuthill's engineers have extensive experience in modifying these standard units, as for Gardner-Denver above. Or they will work with you in developing an entirely new unit, adapted in every detail to the requirements of your application.

Catalog 100 gives an over-all picture of Tuthill's complete line. Write for your copy today. Or, to speed things up, send drawings or other information on your application so that our engineers can indicate ways in which Tuthill's pump know-how can save you money.

Tuthill manufactures a complete line of positive displacement rotary pumps with capacities from ⅓ to 200 gpm; for pressures to 1500 psi; speeds to 3600 rpm.

PUMPS FOR YOUR PURPOSE

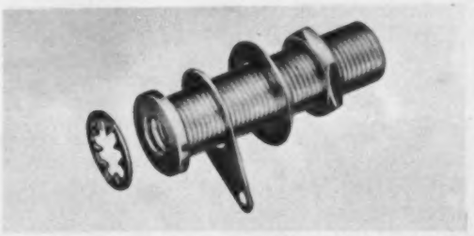
TUTHILL PUMP COMPANY

943 East 95th Street, Chicago 19, Illinois

Circle 86 on Reader-Service Card for more information

ELECTRICAL

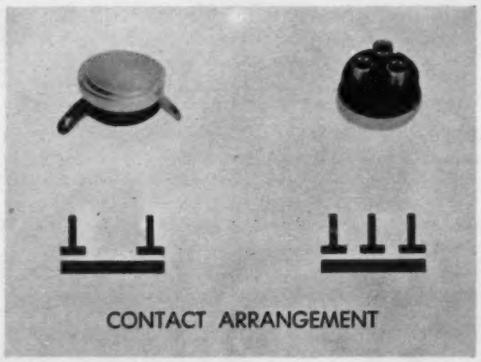
Thick-Panel Phono Jacks 334



This adapter makes it convenient for the technician, hobbyist, service dealer and sound contractor to mount a phono jack in panels up to 1¼ inches thick. Adapter is complete with mounting diagram, mounting nut, washer and lug washer for sleeve circuit. Also included is a lock washer to secure phono jack to adapter bushing. One phono jack, the 3501FP, now can be used for thin panels or thick panels with addition of the No. 371 adapter.

Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.

Small-Appliance Thermostat 335



This unit can be used in its existing form or enclosed in various metal housings. The SA-5000 is ⅝ inch round and ¼ inch thick and includes an open-or-closed, ½-inch, bimetal, snap-acting disc. Vibration-resistant and featuring low voltage drop, the device will handle currents up to 20 amps, voltages to 240 a-c. Various types of terminals are available.

Therm-O-Stats, Inc., P. O. Box 303, Chartley, Mass.

For smart buyers

Want today's best buy in small precision metal stampings and deep-drawn parts? Look over J&H way. J&H engineering ingenuity keeps costs down and speeds delivery. Fine machines insure quality for snug fits in your fabrication. Send for free estimate and Bulletin 81.

Choice of metals and finishes. Sizes to 2.75 in. OD and 3.75 in. deep.

An affiliate of Superior Tube Co. **J&H** JOHNSON & HOFFMAN MANUFACTURING CORPORATION
31 East 2nd Street • Mineola, New York • Pioneer 2-3333

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DEPENDABILITY

THESE HANDS ATTUNED TO QUALITY. The best raw materials . . . machined with modern tools, in the end, rely on the skilled hands of the machinist to turn out reliable hydraulic cylinders. CROSS craftsmen's skill has been forged by years of experience, tempered by the discipline of rigid, station-by-station inspection.

CROSS MANUFACTURING COMPANY
Lawls, Kansas / Phone EA 4-5525

CROSS Engineers Available to You for Free Consultation!

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Circle 88 on Reader-Service Card for more information

Quality... miniature & sub-miniature
Hermetically Sealed

thermostats

- Insulated and grounded models
- Close differential—long life
- Sizes 3/16" & 1/4" dia.
- Tin plated brass cases
- Adjustable from −65° C to 150° C—Specials to 235° C max.
- Special mounting bracket to customer specs.

WIDE VARIETY TO MEET MILITARY and INDUSTRIAL APPLICATIONS

Illustrated here are the results of 25 years experience in the thermal control field. All Chatham Thermostats have a patented positive contact wiping action for longer life.

Write or phone for technical bulletin

CHATHAM CONTROLS CORP.
136 River Road, Chatham, N. J., CRestview 3-7300

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New booklet shows how RIVNUTS® simplify assembly

RIVNUTS are the first one-piece blind rivets with internal threads. Simplify hundreds of fastening and assembly problems. New 20-page booklet shows general applications, method of installation, complete data on sizes, types, materials. Write for "RIVNUT Design Data", *Dept. DN-4, B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Akron, Ohio.*

B.F.Goodrich Rivnuts

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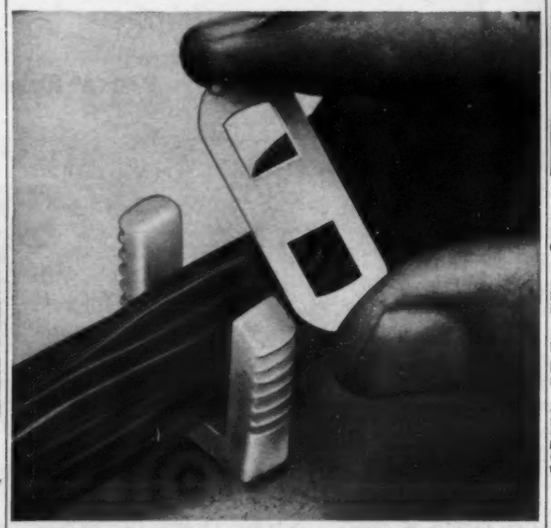


CLAMP WIRE BUNDLES IN SECONDS!

Just place wire bundle inside "U," push keeper down snugly, and this light-weight clamp is securely locked to withstand loadings greater than 50 G's! A Cab-L-Tite* clamp securing 58,000 mils weighs only 0.016 oz.; 8,570,000 mils, 0.832 oz. Proved in aircraft and missiles, Cab-L-Tite* is made of tough DuPont zytel, which meets MIL-P-17091. Removable in seconds for rerouting wires. Write for free literature. *Manufacturer of Bund-L-Tite straps.*

DAKOTA ENGINEERING, INC.
4315 Sepulveda Blvd., Culver City, California *Trade Mark

Circle 91 on Reader-Service Card for more information

NEW! X-acto® PENKnife

The world famous X-acto knife in a brand new "carry-about" case!

- **Famous X-acto Knife Features!** All the features of the famous Interchangeable Blade X-acto Knife. Takes 3 styles of surgically sharp blades—specially designed for precise cutting and slitting operations.
- **So Safe!** Crystal clear "See-Thru" Plastic Cap reveals the blade. No mistaking it for anything but a knife when carried with other capped instruments.
- **Always Convenient!** Just clip it to your pocket and carry it with you everywhere.

For immediate improvement in efficiency, accuracy and safety switch to X-acto!

(Here's an idea! The X-acto PenKnife can be imprinted. It makes an excellent business gift. Complete details, with quantity prices, sent upon request.)

No. 3-ST Actual Size

Open and ready for action! When not in use, replace the cap (like a pen) and clip it to your pocket . . . always handy.

No. 10 — for small, fine general cutting.
No. 11 — for fine angle cutting, deep cuts, narrow spots.
No. 16 — for small holes, notches, stencils — in thin materials.

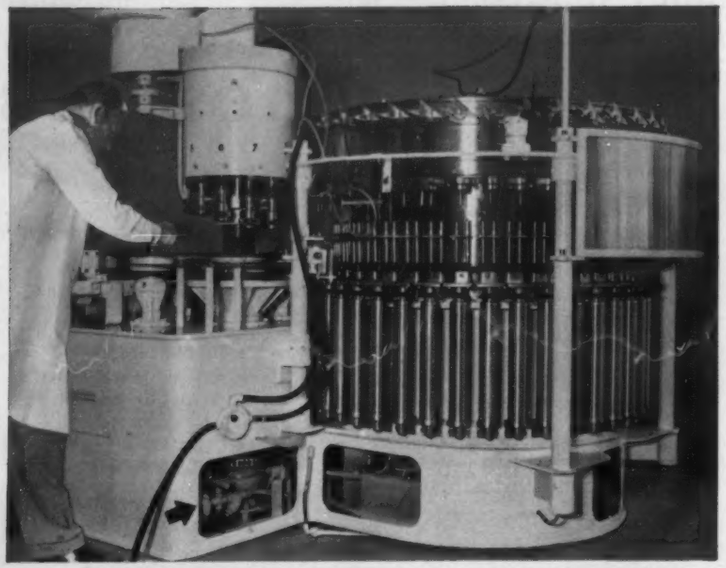
— Sample Offer —

HANDICRAFT TOOLS, Inc.
Div. of X-ACTO, INC.
48-41G Van Dam Street
Long Island City 1, N Y.

Enclosed is $1.00. Please send me a PenKnife with the number_____ (specify #10, 11 or 16 blade) blade and free illustrated catalog of X-acto precision knives, blades, and tools.

Name _____
Company _____
Address _____
City_____ Zone____ State_____

Circle 92 on Reader-Service Card for more information



CEM "Uni-Blend" Filler manufactured by Crown Cork & Seal Co. for beverage industry.

Crown Cork & Seal Co. put B&S Pumps in 50 new machines - never had a failure or a complaint!

The whole top of this new bottle-filling machine revolves on a thin film of oil that is maintained in a large hydrostatic bearing by a pump. The same oil acts as a seal for air, being distributed to bottle-lifting cylinders right through the bearing.

B&S No. 111 ¼ hp motor-driven gear pump (arrow) supplies oil at 35 psi to hydrostatic bearing.

It's easy to see that this manufacturer can't take chances on a pump failure; if the pressure drops, the whole machine shuts down. At customer production rates of up to 320 bottles a minute, it would be a very costly failure.

That's why Crown Cork & Seal Company uses Brown & Sharpe pumps. They are built to the high quality standards of machine tools.

Of the Brown & Sharpe pumps Crown has put in 50 new machines — not one has ever failed or caused a complaint.

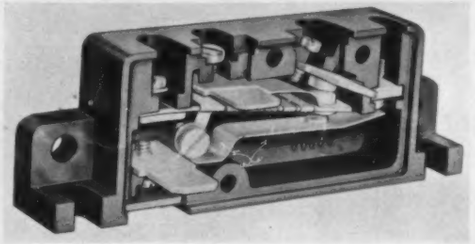
For trouble-free pumps in *your* machines—contact Hydraulics Division, Brown & Sharpe Mfg. Co., Providence 1, R. I., or your nearest B&S engineer-representative.

Brown & Sharpe
PRECISION CENTER

Circle 244 on Reader-Service Card for more information

ELECTRICAL

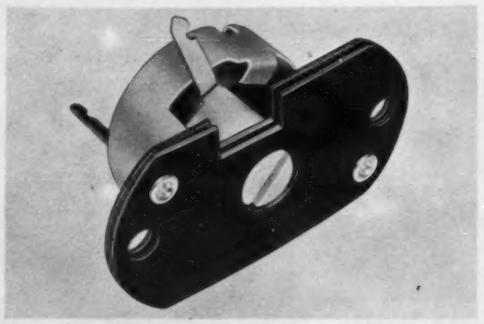
Low-Cost Time-Delay Relay 336



This thermal time-delay relay is designed to simplify circuitry and to be used as a replacement for more expensive magnetic devices. The unit is available with SPST, normally-closed or normally-open contacts, two independent circuits or SPDT. The device features totally-enclosed bakelite housing, two mounting variations and terminals to accept either solder or standard quick-connect wiring. Electrical rating is 100 ma to 10 amps, up to 115v a-c.

E-T-A Products Co., 6285 N. Cicero Ave., Chicago 46, Ill.

Miniature Preset Resistor 337



A ¾-inch-dia, wirewound, variable resistor features an insulated control shaft when mounted on a metal chassis. Connection through cover to rotating content is provided by a solder lug. Type INS-110 is designed for hot chassis or other potentiometer applications and is available with a molded shaft, if desired, for additional safety. Rating is 1¼w at 40C derated to no-load at 105C. Three embossed points on contactor provide continuous contact between contactor, rotor and cover.

CTS Corp., Elkhart, Ind.

The quickest most practical way to put strong threads in soft materials the TAP-LOK® INSERT

SLOTTED

IN SOFTER METALS AND PLASTICS... Has full V-form external threads to provide maximum locking torque and permit wide choice of mating hole sizes. Recommended for soft aluminum, zinc die castings, sand castings and plastics. Meets requirements of MIL-MS-35914.

H-SERIES

FOR HIGHER STRENGTH MATERIALS... Has heavy wall and truncated root external thread and three-hole cutting edges for hard-to-tap higher-strength materials and to meet MIL and other specs calling for Class 3B thread fit for gaging after installation.

P-SERIES

FOR SPARK PLUG SOCKETS ... Designed to eliminate thread wear and renew damaged threads in spark plug sockets in aluminum cylinder heads. Available from stock for standard plug sizes to meet most common needs.

W-SERIES

FOR WOOD... Has coarse pitch external threads offering maximum strength in combination with ability to be driven into thin sections without splitting them. For furniture, cabinets and other wooden parts where strong, permanent threads are needed, or that are frequently assembled and disassembled.

SEE OUR CATALOG IN SWEET'S

Another fastener development from –

TAP-LOK GROOV-PIN CORPORATION

1120 Hendricks Causeway, Ridgefield, N. J.

Circle 93 on Reader-Service Card

Luster-on

ECONOMICAL PROTECTIVE COATINGS FOR BRASS, ZINC, CADMIUM, COPPER, ALUMINUM

The Chemical Corporation offers a complete line of uniform-controlled chromate conversion coatings that provide maximum protection in one, low-cost, simple operation. Available for immediate delivery as liquid or powder.

Always Specify Luster-on —

FOR BRILLIANT CORROSION-RESISTANT FINISHES . . . rivaling chrome for many applications where cost is a factor. Long-lasting, easily controlled application.

FOR CLEAR, BRIGHT and IRIDESCENT COATINGS . . . gives striking, attractive appearance with complete corrosion-protection . . . even when humidity and handling are involved during processing. Also yellow iridescent and olive drab for concealed parts or as a paint bond.

FOR DECORATIVE COLOR . . . on low-cost zinc. Brilliant golds, yellows, blues, greens, violets, reds, brass and copper hues.

FOR ALUMINUM . . . where surface hardness is not of prime importance. Excellent finish for paint bonding.

FOR LASTING BRIGHTNESS . . . on both copper and brass without noxious fuming.

FOR DIE-CASTINGS . . . one quick dip provides uniform finish, ideal as a base for painting.

We'd like to show you what Luster-on can offer you! Send in sample part today for free processing. Data sheets on request.

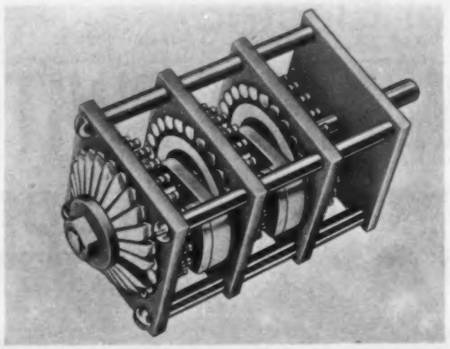
Luster-on . . . the first and still the finest in conversion coatings.

The Chemical Corporation

69 Waltham Ave., Springfield 9, Mass.

Circle 94 on Reader-Service Card

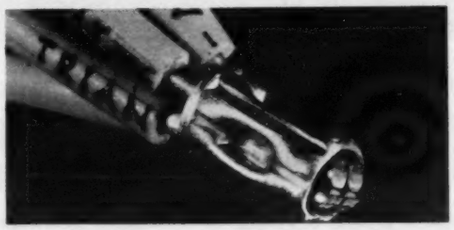
Progressive-Type Switches 338



A series of progressive-type switches, with 20-, 24- or 32-switch positions, shorts out all positions except those actually in use. The device may be used as a control deck for rotary-solenoid operation, for capacitor-decade switching, for sequential-power distribution, for network-sequencing applications and for ammeter and voltmeter switching. Units can be ganged for multiple-deck applications, if needed. Solid silver alloy fingers are designed for self-wiping action to insure low and uniform contact resistance. Contact material and slip rings are also made of solid silver alloy.

Davin Co., Livingston, N. J.

Splice Cap 339



A steel splice cap eliminates the need for twisting wires in splicing a wide range of wire sizes. Eight flutes are spaced an equal distance apart around barrel of the 2008S splice cap. Flutes strengthen cap and help to position it in crimping action. Untwisted conductors are confined in a tight area with no voids between them, eliminating looseness. Caps are listed as "pressure-type wire connectors" and "fixture-type splicing connectors" for 2 No. 18 through 4 No. 12's. Insulators are UL and CSA listed for 600v on building wire and 1000v in fixtures, in applications up to 105C (221F).

Buchanan Electrical Products Corp., Hillside, N. J.

THE SPARE PARTS PROBLEM

The Electronics Business may not be the most tranquil enterprise for anyone to get into — either as a buyer or seller — as evidenced by one of the problems currently plaguing both component makers and their customers. In a nutshell, the trouble is "equivalent" parts, made by a low bidder, failing to behave as the originals did. The explanation, while not as simple as this, seems to boil down to the fact that specs and descriptive data alone aren't enough for anyone to duplicate the *performance* of somebody else's original part. It could be a matter of the inability of the blueprint and the mimeograph machine to be a satisfactory substitute for the original manufacturer's experience, engineering skill, assembly methods and quality control.

No one can argue the merits of saving money, and a good part at the lowest possible cost is a commendable achievement. But when "low quote" means failure of critical equipment and personal hazard, there's not much to be said for economy. On the other hand, if the low man *does* get all the information he needs to build an exact replacement of the original part (assuming he can build it), he is automatically getting the benefit of a great deal of work done and paid for by the original manufacturer. The polite term is usually "proprietary data." Understandably, this arouses the "unfair competition" ogre.

We don't like to give away proprietary information any more than the next person. Neither do we like to see unreliable components endangering life and limb. We think part of the answer* may be to give the second man the same *problem* you gave the original supplier — not the blueprinted solution to imitate. Then test his result as carefully as you did the original successful one. This way, the odds are strongly in favor of your getting something that *will* work — and perhaps work even better.

What do you think the answer is?

* *E. W. Schrader, Western Editor of DESIGN NEWS, made some good observations on this whole subject, see pp. 6-7, Jan. 16 issue.*

SIGMA

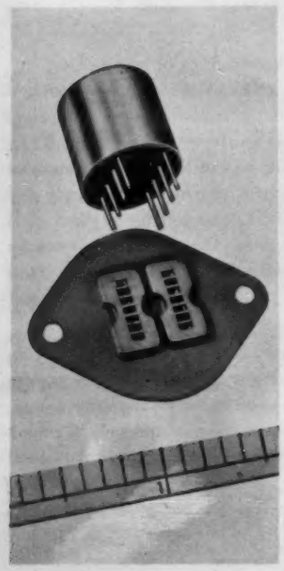
SIGMA INSTRUMENTS, INC.

53 Pearl St., So. Braintree 85, Mass.

Circle 95 on Reader-Service Card for more information

'Plug-In/Solder-In' Transformers 340

Microminiature transformers with .0.030-inch dia brass pin leads spaced 0.100 inch apart "plug in" to a standard five-pin subminiature socket or facilitate "soldering in" for permanent installation. The ½-inch dia metal cases are sealed and potted to meet MIL-T-27A, grade 5.

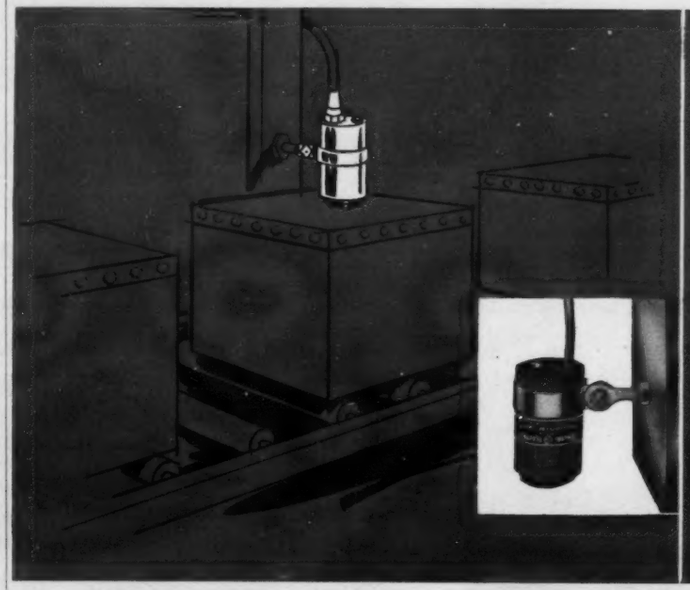


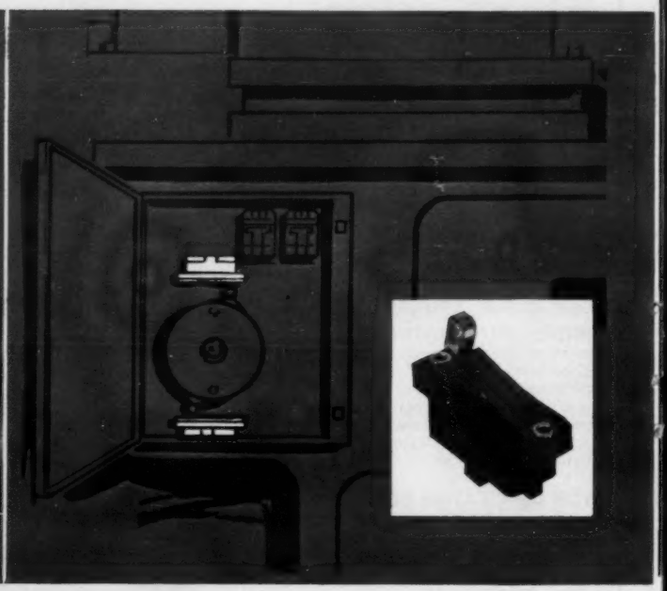
Series U impedance ranges are available from 10 ohms to 300 K ohms. Designs can be offered for a wide range of applications where balance, power and low distortion are required in a microminiature size. Units are also obtainable in a 10-unit decade box-like kit, model C-2650.

James Electronics, Inc., 4050 N. Rockwell St., Chicago 18, Ill.

From General Electric . . .

FOUR NEW LIMIT SWITCHES FOR HARD-TO-SOLVE APPLICATIONS





Priced lower than any comparable switch . . .

NEW PROXIMITY LIMIT SWITCH DETECTS MAGNETIC OR NON-MAGNETIC METAL

Now General Electric announces a proximity switch that gives the maximum reliability of an *all-transistorized* circuitry (no vacuum tubes), self-contained in the operating head. The switch senses ferrous material up to one inch, and even non-magnetic metal up to one-half inch. No shielded cable is required. No physical contact is required to actuate this limit switch, so there are no arms, levers, or shafts to wear out. The proximity switch is encapsulated to prevent entry of coolants or contaminants, and will even operate under water. All these features are combined in the lowest priced proximity limit switch available today.

SPECIFICATIONS

Maximum repetitive accuracy: .005 inch
Minimum differential: .01 inch
Operating time: 20 milliseconds

Temperature: Operates in ambients to 150 F
Application: Can be used with magnetic devices or static control
Sensing head rating: Input—30 volts d-c; Output—30 volts d-c, 250 milliamperes
Publication: GEA-7318

Circle 70 for Proximity Switches

For fast response where space is limited . . .

NEW PRECISION SNAP-ACTION LIMIT SWITCH OFFERS HIGH ACCURACY

General Electric's new precision snap-action limit switch is designed to bridge the gap between the very small and sometimes fragile limit switches, and larger, enclosed limit switches. If space is limited . . . if you don't need the extreme sensitivity of the small switches . . . and if you *do* need heavier-duty operation with good repetitive accuracy and fast response . . . the precision snap-action limit switch is the answer for your application.

The limit switch is available with plunger or roller lever operators. Both types utilize a four-point contact structure (no common connections) in single-pole, double-throw forms, for more flexible circuit applications.

SPECIFICATIONS

Contact arrangement:
SPST—1 NO or 1 NC
SPDT—1 NO-1 NC

Ratings:
AC—up to 40 amps make, 15 amps break; DC—up to 2 amps "make" and break on single-throw forms with .040 gap; Single throw switches are suitable for ½ hp, 115 V or 230 V, a-c. All forms available from 110-600 volts

Publication: GEA-7319

Circle 71 for Snap-Action Switches

Proximity and Precision Snap-action Switches Added to General Electric Line

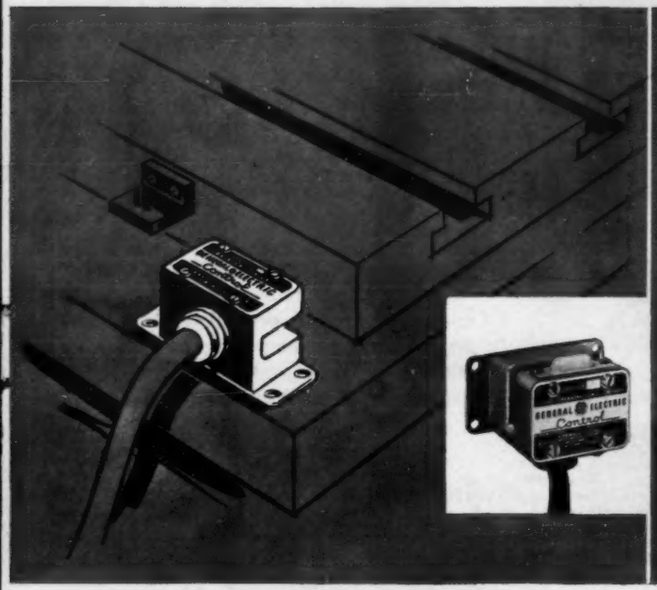
Limit switches are often called the "weak link" in industrial control. But introduction of four new, precision limit switches by General Electric has helped solve this problem. Vane- and magnet-operated limit switches, introduced in 1960, have virtually eliminated mechanical failures on many applications.

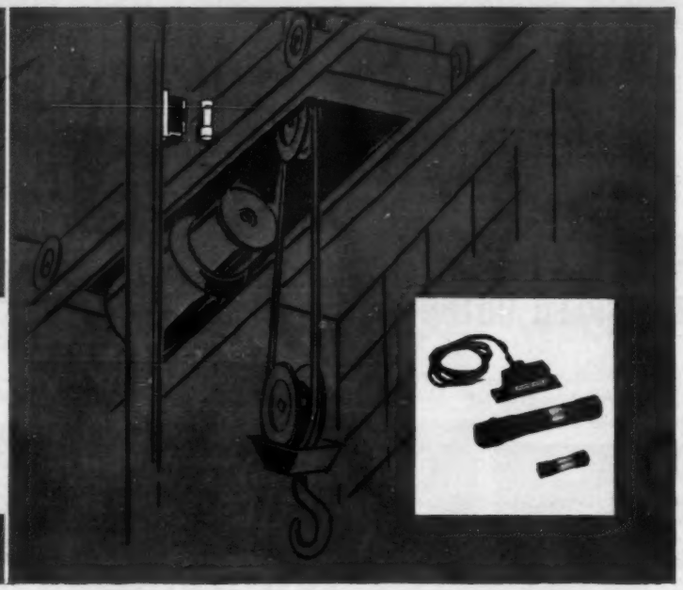
Now G-E announces a new low-priced proximity switch that detects non-magnetic as well as magnetic metal with outstanding reliability. And for high accuracy, fast response requirements where space is limited, General Electric offers its new open, precision, snap-action limit switch. For more information, call your G-E sales engineer or write Section 811-21, General Electric Co., Schenectady N. Y. for publications listed below.

You Get **MEASURABLE ADVANTAGES**
WITH GENERAL ELECTRIC CONTROL

Progress Is Our Most Important Product

GENERAL ELECTRIC





For leverless operations . . .

NEW VANE-OPERATED LIMIT SWITCH IS ENCAPSULATED FOR LONGER LIFE

The completely encapsulated design of the new vane-operated limit switch seals out liquids, dirt, and metal chips. The switch has no arms, levers, or shafts to fail. The result is extremely long life. For example, with small a-c relays, the expected operating life is 30 to 50 million operations. The switch is actuated by passage of a separate ferrous vane through a slot. There is no physical contact, and the only moving parts are contacts which flex slightly. Price is only slightly higher than conventional limit switches.

SPECIFICATIONS

Response time:	.001 second
Repetitive accuracy:	.0025 inch or less
Contact rating:	0.75 amp "make" at 115 volts a-c 0.2 amp carry and break at 115 volts a-c
Differential:	⅛ inch (NO contact) ¼ inch (NC contact)
Contact arrangements:	1 NO or 1 NC
Publication: GEA-6995	

Circle 72 for Vane-Operated Switches

Where operating path is variable . . .

NEW MAGNET-OPERATED SWITCH OPERATES UP TO 4 INCHES FROM MAGNET

General Electric's new magnet-operated limit switch offers the features of the vane-operated switch, plus the ability to detect objects moving in erratic paths. The switch is operated by passage of a permanent magnet near the face of the switch. The larger of two available magnets can be approximately four inches from the switch, and still actuate it. A wide variety of mounting arrangements is possible: Either switch or magnet may be mounted on moving part, or both may be stationary with vane passing between.

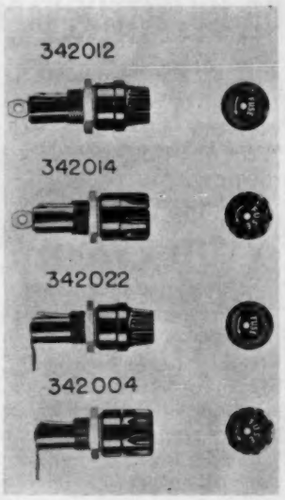
SPECIFICATIONS

Response time:	.001 second
Repetitive accuracy:	With ⅝ inch dia. magnet—±.003 inch With 1⅛ inch dia. magnet—±.007 inch
Contact rating:	0.75 amp "make" at 115 volts a-c 0.2 amp carry and break at 115 volts a-c
Contact arrangement:	1 NO
Publication: GEA-7305	

Circle 73 for Magnet-Operated Switches

Miniature Fuse Posts 341

A line of four 3AG miniature fuse posts with two different knob and connecting terminal combinations is designed to fit every conceivable application. All models have a maximum current rating of 15 amp, a maximum voltage rating of 250v and are UL approved. Body and knob materials meet MIL-P-14E type CFG and can be supplied with fungus treatment as per JAN-T-152 and



JAN-C-173. Models 342004 and 342022 require only 1-1/64 inches back-of-panel space. Models 342014 and 342012 require only 1-11/32 inches back-of-panel space. Mounting hardware and mounting hole are common to all models. Units will withstand 15 lb-in mounting torque. All models meet MIL-STD-202 and MIL-E-5272 vibration standards.

Littelfuse, Inc., Des Plaines, Ill.

CUSTOM MADE CLEVELAND SPEED VARIATOR BED PLATE ASSEMBLIES GIVE PRECISION CONTROL OF INFINITELY VARIABLE SPEED OUTPUT

Now, for the first time Cleveland's *New* Motorized Speed Variator may be engineered into compact, pre-tested drive arrangements for powering your driven equipment in non-hazardous locations. These assemblies are accurately pre-aligned at the factory—require little maintenance, only periodic oil changes.

HERE'S THE COMPLETE STORY:

- Requires only slightly more space than an equally rated standard electric motor
- Provides variable output speeds over 9:1 and 6:1 ranges
- A complete line featuring 5 sizes from ½ to 15 HP
- Integral "pancake" style AC radial air gap motors conforming to NEMA design "B" specification
- Provides speed holding accuracy up to 0.1% with uniform loading
- Output speeds smoothly and easily adjusted while operating under load

These versatile mechanical-type drive units are especially applicable for chemical blending operations where it's important to hold fixed speeds. They can be run at definite speed settings for extended periods without localized wear of running parts or freeze-up of speed changing mechanism.

Variator is a true torque converter—provides high torque at low speeds for constant HP applications—gives traction even during periods of extreme overloading.

For complete engineering information on the *New* Cleveland Motorized Speed Variator, write for free, illustrated bulletin Number 275 or contact your Cleveland representative today.

Cleveland Worm & Gear Division
Eaton Manufacturing Company
3292 East 80th Street • Cleveland 4, Ohio

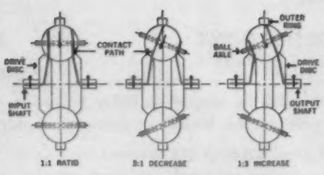
CONTROL VERSATILITY

For manual operation, a hand wheel is mounted on an extension of the control worm and equipped with a turns counter to indicate relative speed settings

For electrical remote - controlled operation, a small single-phase motor drives the worm through chain and sprockets, or enclosed gearing

This pneumatic operator accurately positions the control worm in direct relationship to a 3 to 15-pound air signal

CLEVELAND SPEED VARIATOR

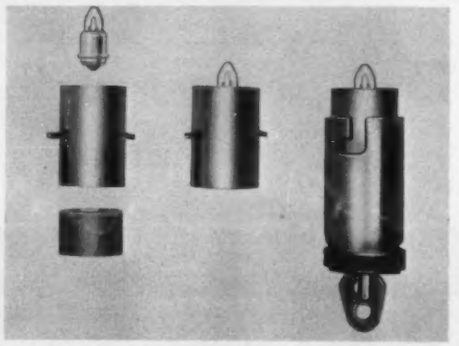


How The Speed Variator Works
Power is transmitted through input shaft to a beveled drive disc in contact with axle-mounted alloy steel drive balls. Input shaft rotation causes balls to rotate about their axles. Power is then transmitted from all rotating balls to output shaft by similar ball-disc contact on the output side. Output speed is determined by relative lengths of contact paths on input and output sides of the balls. By tilting both axles and balls, relative lengths of the two contact paths are varied to give increasing or decreasing ratios as shown on the sketches.

Circle 99 on Reader-Service Card for more information

ELECTRICAL

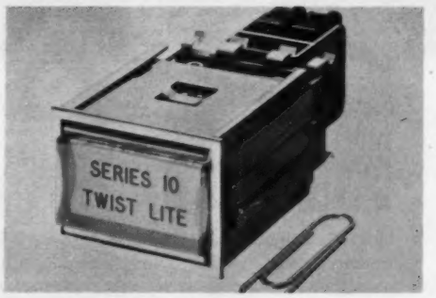
Miniature Lamp Adapter 342



T-1 ultraminiature incandescent lamps will fit any standard miniature bayonet-base socket with the use of this versatile lamp adapter. Unit was created to fill the need for users of this ultra-small lamp (only ⅛-inch dia by ⅜-inch long) for a fast, easy method of mounting and using the T-1 lamp. The device is available with or without the ultraminiature lamp.

Industrial Electronic Engineers, Inc., 5528 Vineland Ave., North Hollywood, Calif.

Switch Light 343



"Twist Lite" permits rebulbing and changing of colors, lens or legends without use of any special tools. Completely assembled units or separate assemblies are available. Mounting is accomplished from panel front and may be vertical, horizontal or matrix. Switches clip to rear of unit for ease of maintenance. Switches available include 2PDT momentary action, 4PDT momentary action, 2PDT alternate action and magnetic holding. Each unit accepts four bulbs, industry-type 327, and has corrosion-piercing bulb contacts.

Master Specialties Co., 956 E. 108th St., Los Angeles 59, Calif.

SIMPLIFY DESIGN PROBLEMS

Uneven loads will not sway, tip or tilt because off-center load is evenly distributed on both springs. Variable ratio springing adjusts self to road conditions. Deflection rate changes automatically to produce exactly right capacity to properly balance spring tension with load. Lower center of gravity without sacrifice of clearance. Only four bolts to mount . . . no assembly required. Just two friction bearings with renewable friction inserts control spring action.

Prior
LEVEL-LOAD
TRAILER AXLE

PRIOR PRODUCTS, INC. / P. O. BOX 7608 · DALLAS, TEXAS

Circle 100 on Reader-Service Card for more information

Eliminates Lugging! Provides Secure Connections!

CURTIS **Type "CT" Terminal Blocks**

Now General Purpose Phenolic for Temperatures to 300°F.

Specifications:

Rated—25 amperes, 750 volts.
Wire—for No. 12 to No. 18 AWG.
Available—1 thru 50 terminals.
Applications—industrial control and moderate power circuits.
Terminals—3PC wire clamp assemblies, excellent pull-out strength.

Write for Bulletin DS-116

Curtis Terminal Blocks Make Better Connections Economically—Quickly. A type for every purpose.

CURTIS **DEVELOPMENT & MFG. CO.**
3220 N. 33rd Street, Milwaukee 16, Wisconsin

Circle 101 on Reader-Service Card for more information

WECKESSER
CABLE CLIPS

of all nylon . . .
for high heat or other severe conditions

of ethyl cellulose . . .
for maximum economy in average conditions

Light weight, strong, chemically resistant. No short circuits, no grounds, no corrosion, no rust. Only one fastener needed Sizes to 1¼ inches. Write for free samples and price sheet.

WECKESSER COMPANY
5707 Northwest Hwy., Chicago 46, Ill.

Circle 102 on Reader-Service Card for more information

designers

→ *moving air or materials*

Send for this
free catalog

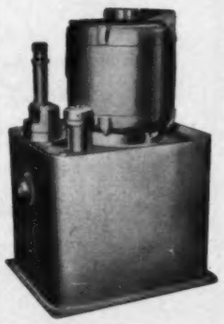
Catalog 92 has 24 pages filled with useful information on neoprene coated fabric, wire reinforced Flexaust hose and Portovent retractable duct applicable to their use in air and materials handling, fume and dust control. Includes data on pressures, friction losses, construction, accessories, and other details essential to good design.

THE FLEXAUST COMPANY
DEPT. DM 10 • 100 PARK AVE • NEW YORK 17, N • Y •

Circle 103 on Reader-Service Card for more information

Designer's Fact File from DENISON

PUMPING UNITS



Vertical-type design with all components mounted as a single unit on top cover for easy access. Reservoir base with capacities from 5 to 35 gallons. Adjustable relief valve provides simple control of maximum pressure. Standard NEMA, C-base type motor. Available with optional accessories—coolers, filters, gauges and temperature gauges. Volume capacities from one to 18 gpm, pressure ranges from 800 to 3000 psi.

Write for full details in Bulletin PU-3.

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1190 Dublin Road • Columbus 16, Ohio

HYDRAULIC PRESSES
PUMPS • MOTORS • CONTROLS

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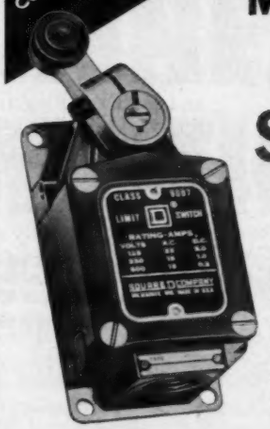
DENISON HydrOILics

Circle 104 on Reader-Service Card for more information

YOU GET **eleven** CONTACT ARRANGEMENTS IN **one**

with this
HEAVY DUTY Machine Tool
LIMIT SWITCH!



- oil-tight
- easy stocking
- easy mounting
- rugged mechanism
- 80 degrees overtravel
- 11 contact arrangements
- simple adjustment
- variety of arms
- variety of baseplates

Write for Bulletin 9007 T. Address Square D Company, 4041 N. Richards St., Milwaukee 12, Wisconsin.

SQUARE D COMPANY
wherever electricity is distributed and controlled

Circle 105 on Reader-Service Card for more information

HANSEN

SERIES HK® QUICK-CONNECTIVE

TWO-WAY SHUT-OFF COUPLINGS

QUICK CONNECTION
with instant automatic flow

QUICK DISCONNECTION
with instant automatic shut-off
...prevents loss of liquid, gas, or pressure

As easy as plugging in your electric shaver...

Write for the Hansen Catalog

Here is an always ready reference when you want information on couplings in a hurry. Lists complete range of sizes and types of Hansen One-Way Shut-Off, Two-Way Shut-Off, and Straight-Through Couplings—including Special Service Couplings for LP-Gas, Steam, Oxygen, Acetylene, etc.

To connect a Hansen Two-Way Shut-Off Coupling, you merely pull back the sleeve and push the Plug into the Socket. To disconnect, just pull back the sleeve. No tools required. When Coupling is disconnected, similar valves in Socket and Plug shut off both ends of fluid line circuit—practically eliminating spilling of fluid at instant of disconnection.

Available in brass or steel, with female pipe thread connections from ⅛" to 1½" inclusive.

Representatives in Principal Cities ...see Yellow Pages

SINCE 1915 — QUICK-CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

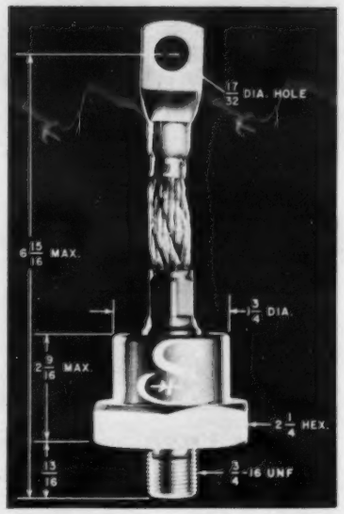
4031 WEST 150th STREET • CLEVELAND 35, OHIO

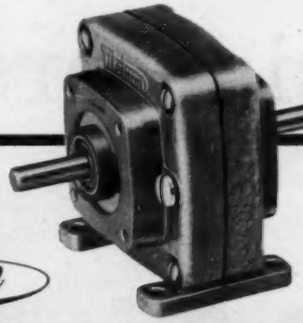
Circle 106 on Reader-Service Card for more information

400-Amp Silicon Rectifiers — 344

High-power, 400-amp-rated, silicon rectifiers are available in stud-mounted and flange-mounted configurations to replace several smaller units. Rectifiers are sealed hermetically and adaptable for commercial, industrial or military rectifying applications. They are of rugged construction with solid copper bases, leakfree mechanical-electrical connections and all exterior surfaces are protected with high-temperature, noncorrosive paint or plating. Maximum thermal resistance is 0.1C per watt between junction and base edge. All units are rated at 400 amps at 120C and 160 amps at 175C case temperature. They feature a peak voltage rated up to 600v.

Standard Rectifier Corp., 620 E. Dyer Rd., Santa Ana, Calif.





FROM Metron

A PART OR A PACKAGE

A PART: *Bantam speed changers—a small size precision workhorse*
RATIOS: 646 from 1:1 to 85184:1
HORSEPOWER: 0.1 maximum
TORQUE: 130 oz-in
SPEED: 10,000 RPM maximum
BACKLASH: 15′ maximum (Series 11)
WEIGHT: 16 to 45 oz depending upon ratio
BEARINGS: double, heavy-duty ball
DELIVERY: 10 days

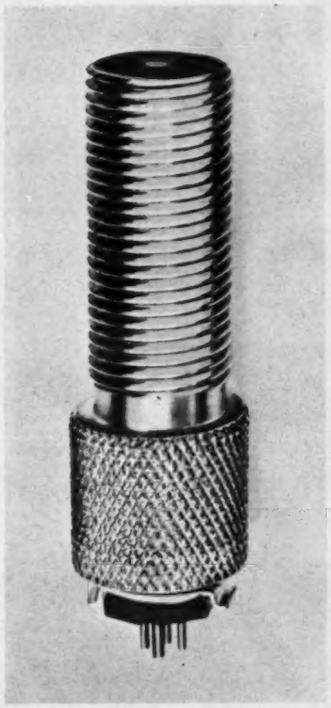
A PACKAGE: Bantam speed changers are only one product in Metron's complete line of small speed changing components. Call on our engineers for design help with your speed changing or control problems. Tell us what *results* you're after—what your inputs and loads are. We'll come up with an output package to do the job efficiently and economically. Send your prints today!

Metron — **METRON INSTRUMENT CO.**
432 Lincoln, Denver 3, Colo., PE 3-3764, TWX: DN 194

Circle 107 on Reader-Service Card for more information

Motion-to-Pulse Converter 345

By passing magnetizable elements (for example, gear teeth) near probe of this pickup, pulses are generated of a frequency proportional to number of teeth passing probe per unit time. Current for pickup is generated by energizing one of its two coils with d-c. High output can be regulated by controlling d-c excitation. Output form, consisting of discrete pulses, is well suited to digital applications. The device is complete with 126 series Amphenol integral male



and mating locking-type female connector.

Kinelogic Corp., 1256 N. Fair Oaks Ave., Pasadena, Calif.

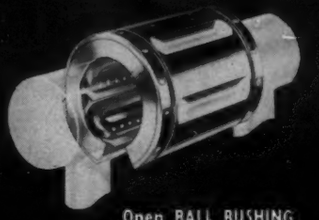
Circle 108 on Reader-Service Card

NOW! *Adjustable Diameter and Open*

THOMSON **BALL BUSHINGS**

Adjustable Diameter BALL BUSHING for Zero Clearance

Precision Series "A" and Low Cost Series "B" BALL BUSHING



Open BALL BUSHING for Zero Clearance on Supported Shafts

LOW FRICTION · ZERO SHAKE OR PLAY
ELIMINATE BINDING AND CHATTER
SOLVE SLIDING LUBRICATION PROBLEMS
LONG LIFE · LASTING ALIGNMENT

Also manufacturers of NYLINED Bearings . . . Sleeve Bearings of DuPont NYLON

The BALL Bearing for *all* your

LINEAR MOTIONS

Sliding linear motions are nearly always troublesome. Thousands of progressive engineers and designers have solved this problem by application of BALL BUSHINGS on *guide rods, reciprocating shafts, push-pull actions,* or for support of *any mechanism that is moved or shifted in a straight line.*

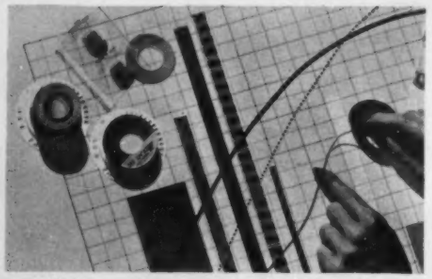
Improve your product! Up-date your design and performance with Thomson BALL BUSHINGS!

The various types cover a shaft diameter range of ⅛" to 4". Small sizes available in Stainless Steel. Write for literature and name of our representative in your city.

THOMSON INDUSTRIES, Inc.
Dept. J, MANHASSET, NEW YORK

PROGRESSIVE MANUFACTURERS USE BALL BUSHINGS–A MAJOR IMPROVEMENT AT A MINOR COST

Colored Transparent Tapes 346



Self-sticking tapes may be ordered in 20 solid colors and 10 patterns. Tapes are manufactured in 10 standard widths from 1/32 to 1 inch. They are designed for use in preparation of artwork, slides, transparencies and associated fields. When overlaid on maps, drawings, layouts and graphs, they introduce sections of color without obscuring any pertinent detail. Their write-on, nonreflecting surface makes them a useful drawing aid.

ACS Tapes, Inc., 217 California St., Newton 58, Mass.

Nylon Strapping 347

A nonconductive nylon strapping is manufactured in widths from 0.160 to 5/8 inch, in thicknesses from 0.030 to 0.070 inch, in various hole sizes and spacings, or nonperforated. Strapping is available in either black or natural nylon from stock, in 25- or 50-ft-roll dispensing packages. To facilitate installation of strapping, several accessory items, also made of nylon, are offered. A ratchet buckle provides a nonslip, permanent fastener for tight bundles of cables, wires and tubing. A stud button locks both ends of strapping when pushed through matching perforations. To solve the problem of mounting conduit bundled with perforated nylon strapping, two types of mounting tabs fasten with one screw to wall or panel either before or after assembly of wiring. A two-hole nylon mounting cradle is designed for premounting before strapped bundles are installed. Nylon is suitable for service between —60 and 275F.

Weckesser Co., Inc., Dept. DN-1, 5701 Northwest Hwy., Chicago 46, Ill.

1961 DESIGN ENGINEERING

and Concurrent ASME Conference

Put those important product drawings and specifications in your briefcase. Make a list of original equipment you want to know more about. Get a big notebook, and pack a pair of comfortable walking shoes. Then head for Detroit's magnificent new Cobo Hall and the biggest, most exciting Design Engineering Show in history.

The best design and development work that over 350 companies can come up with is ready for you to see, compare, and study. The top application engineers of these companies will be on hand to discuss their products with you – go over drawings and specifications—make suggestions—offer you the benefit of their cumulative experience.

SHOW COBO HALL Detroit · May 22-25

Everyone with design-engineering responsibility will benefit from DESIGN WEEK IN DETROIT – and every company will profit by *making sure* its design-responsible executives and engineers have this once-a-year chance to see the latest and best in original equipment. There are three mornings and evenings of concurrent ASME Conference sessions waiting for you, too – all devoted to *"Designing for the Competitive Market"*. There is much for you in every one of the Conference's 24 major papers.

For hotel reservations write the Detroit Convention & Visitors Bureau. For other information contact:

CLAPP & POLIAK, Inc. *Exposition Management*
341 Madison Avenue • New York 17 • MUrray Hill 4-3432

Temperature-Detecting Crayons 348

Welding engineers and metallurgists working in the field of jet propulsion and space exploration should find "Tempilstiks" a convenient means of determining high temperature levels with an accuracy within one percent. Temperatures in the range from 2000 to 2500F now can be determined, calibrated for 50F intervals instead of every 100F. These items bring to 86 the total number of available crayons, with temperature ratings covering the range from 100 to 2500F in systematic steps.

Tempil Corp., 132 W. 22nd St., New York 11, N. Y.

'Make-Your-Own' Nameplate 349

A "do-it-yourself" kit is offered for in-plant manufacture of etched metal parts such as nameplates, instrument dials and panels, schematics, serial numbers, labels, security badges, seals, tool checks, etched photos and templates. The process, tradenamed "Fotofoil", can produce a high quality of etched part in seven minutes.

Miller Dial & Name Plate Co., 4400 N. Temple City Blvd., El Monte, Calif.

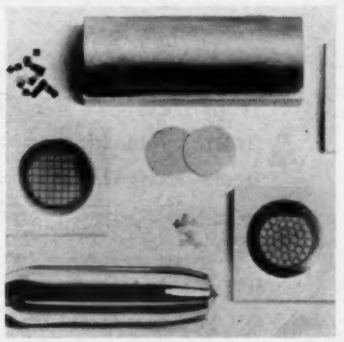
Circle 243 on Reader-Service Card for more information

Glass-Epoxy Laminate 350

A glass laminate, with a thickness tolerance of ±0.004 inch on 1/16-inch sheets, is available in 36- by 42- and 36- by 84-inch sheet sizes, with copper-clad or unclad surfaces. Close-tolerance FF-91 industrial grade is micrometer-rated over 100 percent of the sheet area, exceeding Class II tolerances of military specification MIL-P-13949B of ±0.005 inch for 1/16-inch thick sheets.

Formica Corp., a subsidiary of American Cyanamid Co., Cincinnati, Ohio.

Semiconductor Processing 351



Semiconductor materials processing is obtainable for the slicing, lapping, dicing and ultrasonic cutting of silicon, germanium, ceramics and 3-5 compounds. Slicing is maintained to 0.0005 inch and better parallel, and lapping to 0.0002 inch. Along with mechanical fabrication of semiconductor materials, a complete service of crystal orientation is available for electronics, semiconductor and scientific fields.

Allen-Jones, Inc., Semiconductor Materials Processing Div., 1345 Gaylord St., Long Beach, Calif.

Circle 109 on Reader-Service Card

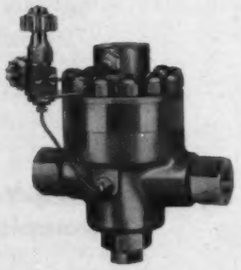
VICTOR "CLEAN" REGULATORS

Control gases safely and accurately to 10,000 psig.

Victor high pressure gas regulators are cleaned, assembled, tested and packaged under carefully controlled conditions to insure maximum product reliability. Cleaning is performed to Victor standard or to customer specifications in a room approved by industry and military agencies. Regulators shown here are typical of the available models covering a range of pressures to 10,000 psig. and capacities of 80,000 scfm. at —67° F. to +250° F. Write for Regulator Inquiry Form 361B and regulator bulletins.

GD700 SERIES
GAS-O-DOME REGULATORS

Bronze or stainless steel
Pilot operated—low torque
Inlet to 10,000 psig.
Outlet to 10,000 psig.
Flows to 250 scfm.
Panel Mounting

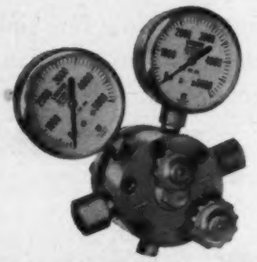


GD40, GD90, GD100, GD200 SERIES
GAS-O-DOME REGULATORS

Bronze or stainless steel
Remote or integral controlled
Inlet to 6,000 psig.
Outlet to 6,000 psig.
Flows to 80,000 scfm.
Panel mounting if desired.

LR SERIES LOADER REGULATORS
BPR SERIES BACK PRESSURE
REGULATORS

Bronze or stainless steel
Inlet to 10,000 psig.
Outlet to 10,000 psig.
Flows to 10 scfm.
Low operating torque:
40 inch lbs. at 7,000 psig.
60 inch lbs. at 10,000 psig.
Panel mounting.



GD60 AND GD80 SERIES
GAS-O-DOME REGULATORS

Bronze or stainless steel
Remote or integral controlled
Inlet to 10,000 psig.
Outlet to 10,000 psig.
Flows to 2,000 scfm.
Panel mounting if desired.

VICTOR ...tors

VICTOR EQUIPMENT COMPANY
844 Folsom St., San Francisco 7 • 3821 Santa Fe Avenue, Los Angeles 58
1145 E. 76th St., Chicago 19
J. C. Menzies & Co., Wholly-Owned Subsidiary

Mfrs. of high pressure and large volume gas regulators; welding & cutting equipment; hardfacing rods; blasting nozzles; cobalt & tungsten castings; straight-line and shape cutting machines; roller and idler rebuilding machines.

Pressure-Sensitive Vinyl Tape 352

An electrical-grade vinyl plastic tape for continuous operation at Class A (105C) is resistant to sunlight, rain, snow, salt water and alkalies, and is self-extinguishing. Tape No. 66 is 11 mils in thickness, has a tensile strength of 35 lb-in width, electric strength of 11,000v, insulation resistance of 1 x 10^6 megohms, electrolytic corrosion factor ratio of 1 and will not corrode copper.

Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.

Two-Part Casting Resin 353

"Stycast 3180M" is a low-cost epoxy casting resin. Designed for modern production techniques, its mixing ratio of 1:1, by either weight or volume, makes it adaptable to either production-dispensing equipment or to manual mixing for smaller batches. The material is compatible with electrical components and circuits. It bonds well to most materials. Its machinability is good and coupled with its high insulating qualities, moisture resistance and thermal stability, it answers most requirements where cost is a factor.

Emerson & Cuming, Inc., Canton, Mass.

Electrical-Grade Nylon 354

"Zytel 31" nylon slab is available in sizes 12 by 12 inches, in thicknesses from 1/16 to 1 inch, and 12 by 36 inches, in thicknesses from 1/16 to ½ inch. Low moisture absorption, improved dimensional stability, easy machinability and good electrical properties combine in "Zytel 31" to make the material suitable for mass-produced electromechanical parts.

A. L. Hyde Co., Grenloch, N. J.

Circle 110 on Reader-Service Card

Lamb Electric's "Clean Room" insures fractional horsepower motor perfection

For assembly of small precision gear motors, Lamb® Electric has installed an air-conditioned, dust-free "Clean Room". This innovation, primarily for the assembly of these custom-built motors, is essential for eliminating even particles of dust.

The "Clean Room" is typical of progressive Lamb thinking that insures perfection in fractional horsepower motor design and manufacture.

Do you have a special motor problem? . . . Here's what you can expect from Lamb! *Into the design* of a Lamb motor goes years of experience in powering components for aircraft, domestic and industrial products. *Out of the design* comes a personalized motor that's dependable, smooth and efficient.

Cost-wise you're way ahead, because Lamb Motors are mass-produced at the most favorable cost.

Write today for descriptive folder. Or ask to have a District Engineer call and set up a personalized "Motor Conference".

THE LAMB ELECTRIC COMPANY · Kent, Ohio

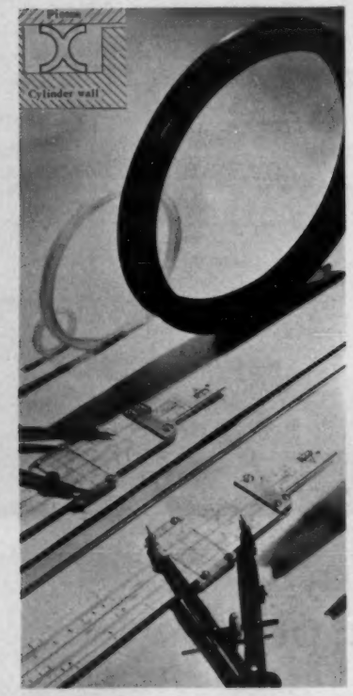
A Division of American Machine and Metals, Inc.
In Canada: Lamb Electric—Division of Sangamo Company, Ltd.
Leaside, Ontario

Lamb Electric
SPECIAL APPLICATION FRACTIONAL HORSEPOWER **MOTORS**

Divisions of American Machine and Metals, Inc., New York 7, New York TROY LAUNDRY MACHINERY
RIEHLE TESTING MACHINES • DE BOTHEZAT FANS • TOLHURST CENTRIFUGALS • FILTRATION ENGINEERS • FILTRATION FABRICS
NIAGARA FILTERS • UNITED STATES GAUGE • RAHM INSTRUMENTS • LAMB ELECTRIC CO. • HUNTER SPRING CO. • GLASER-STEERS CORP.

'Teflon' O-Ring 355

A seal ring which combines the characteristics of rubber O-rings with the physical properties of "Teflon" permits installation with either a slight or a moderate seal contact pressure or interference. "X-Seals" should improve performance in many difficult applications on oscillating, reciprocating and rotating shafts, as well as in static applications. Design specifications



include extended-operating temperature range of —300 to 500F, elimination of lubrication, low breakaway friction, inertness to chemical attack and no aging deterioration. "X-Seals" are supplied in 126 standard O-ring sizes in the range of 0.114 inch ID to 4.475 inches ID.

Allegheny Plastics, Inc., 25 Thorn Run Rd., Coraopolis, Pa.

Circle 111 on Reader-Service Card

+ with local service that gives you the sales advantage of faster product delivery

You can GIVE prompt, dependable delivery when you GET prompt, dependable delivery. That's the plus value your local Fabricator and Distributor of Formica Industrial Plastics can add to your products. His organization is equipped to fabricate and deliver Formica parts quickly. Ready to deliver Formica sheets and rods directly from his local inventories.

There's a Fabricator and Distributor of Formica Industrial Plastics in every major U.S. industrial market. Check the list at right for the one nearest you. Give him a call today. Learn how his local facilities can help put the plus in your products...faster.

FORMICA® Industrial Plastics

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subsidiary of CYANAMID

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Faster Delivery of
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Sheets and Fabricated
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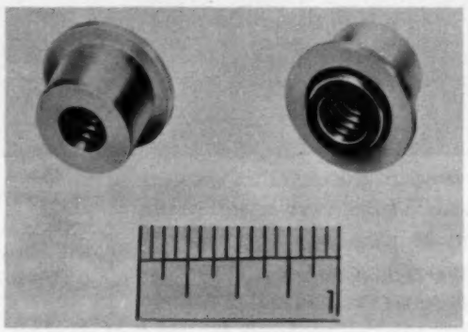
Birmingham.....Vulcan Electric Distrs.
ARIZONA:
Phoenix.....Kiva Sales Co. Inc.
CALIFORNIA:
North Hollywood.....Plastronics
El Cajon.....Dutton Mfg. Co.
Los Angeles.....Conroy & Knowlton, Inc.
Leed Insulator Corp.
Tri-State Supply Co.
Plastic Stamping, Inc. (Pomona)
San Francisco.....Laminated Fabricators
Tri-State Supply Corp.
San Diego.....Ridout & Co.
COLORADO:
Denver.....Plasticrafts, Inc.
Englewood.....Regal Plastic Supply Co.
CONNECTICUT:
Unionville.....Fabricon Corp.
DISTRICT OF COLUMBIA:
Arlington.....Milton H. Brooks & Son
FLORIDA:
Miami.....Modern Plastics
GEORGIA:
Atlanta.....Southeastern Plastic Sales Co.
ILLINOIS:
Chicago.....Colonial Kolonite Co.
Tingstol Co.
INDIANA:
Indianapolis.....Hyaline Plastics Corp.
Michigan City.....Television Associates, Inc.
KENTUCKY:
Louisville.....C. Lee Cook Co.
LOUISIANA:
New Orleans.....Prager, Inc.
MARYLAND:
Baltimore.....Diecraft
MASSACHUSETTS:
Boston.....Insulating Fabricators of N.E.
MICHIGAN:
Dearborn.....F. B. Wright Co.
Detroit.....Chas. R. Mueller & Sons
Grand Rapids.....Novel Products
Jackson.....Plastigage Corp.
MINNESOTA:
Minneapolis.....Special Parts, Inc.
St. Paul.....Plastics, Inc.
MISSOURI:
Kansas City.....Brook Beatty Co.
St. Louis.....Harris Mfg. Co.
NEW JERSEY:
East Rutherford.....Insulating Fabricators, Inc.
NEW MEXICO:
Albuquerque.....Plasticrafts, Inc.
NEW YORK:
Buffalo.....Curbell, Inc.
Long Island.....Thomas J. Long, Inc.
New York City...Commercial Plastics & Supply Co.
Richmond Hill, Queens.....Comco Plastics
Rochester.....General Circuits, Inc.
Syosset, L. I.....Frank Products
West Nyack.....Plasticraft Products Corp.
NORTH CAROLINA:
Gibsonville.....Engineered Plastics, Inc.
SOUTH CAROLINA:
Spartanburg.....Insulating Fabricators, Inc.
OHIO:
Cleveland.....Jaco Products Co.
Cincinnati.....Durham Plastics, Inc.
Columbus.....Dayton Plastics, Inc.
Dayton.....Dayton Plastics, Inc.
OKLAHOMA:
Tulsa.....Ideal Specialty Co.
PENNSYLVANIA:
Harrisburg.....D. & H. Dist. Co.
Philadelphia.....Laminated Materials
Mascher & Lippincott
Pittsburgh.....Earl B. Beach Co.
Chrishon Fabricators, Inc.
TENNESSEE:
Memphis.....Norrell, Inc.
Nashville.....Plastic Fabricators Co.
TEXAS:
Fort Worth.....Plastelite Engineering Co.
Service Engineers, Inc.
Standard Parts & Equipment Corp.
Houston.....Houston Gasket & Packing
Replacement Parts Co.
UTAH:
So. Salt Lake City.....Plastic Products of Utah
VIRGINIA:
Bristol.....Williams Co.
Norfolk.....Norva Plastics
Richmond.....Plywood Center
WASHINGTON:
Seattle.....Tri-State Supply Co.
WISCONSIN:
Milwaukee.....General Plastics, Inc.
West Allis.....Colonial Kolonite Co.

Anodized-Aluminum Foil 356

A comb-shaped dispenser for serially numbered, pressure-sensitive, anodized-aluminum foil marker strips is obtainable in any combination of letters and/or digits in consecutive order, for quick removal and instant application to any surface. Markers are individual anodized tabs, each debossed with a serial number in proper sequence and each an integral part of the dispenser. Markers are installed with no drilling, no tapping and no screws or pins—their adhesive back holds them permanently in place.

North Shore Nameplate Div., Anodyne, Inc., 1270 N. W. 165th St., North Miami Beach 69, Fla.

Corrosive-Fluid Seal 357



This small, beryllium-copper, rotary-face seal finds applications in jet fuel and oronite systems of high-performance aircraft and in other applications where unusually high pressure demands and extended temperature ranges occur. The seal comprises a retaining housing which holds a machined bellows, faced with carbon, "Teflon" or similar materials suited to specific needs. The bellows and housing are either heliarc welded or bonded with epoxy. Seal is engineered for a maximum pressure differential of 10,000 psi and a temperature range of —65 to 450F. Seal is offered in limited sizes from ¼-inch shaft size and up.

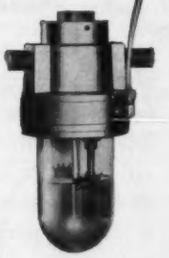
Hydrodyne Corp., 7352 Coldwater Canyon Ave., North Hollywood, Calif.

HANNIFIN *Crown*
delivers air the way you want it!

With "Crown" remote controlled units, you can filter and drain overhead air lines, control regulators from below, and fill lubricators without climbing.
Or, with our completely standard units . . .

. . . you can provide just the right amount of filtered, regulated and/or lubricated air right at your machine.

NEW! PULSE-LUBE . . . for off-beat air flow



If air flow is uphill or light or so infrequent that air-borne lubrication won't solve your problem, you can deliver oil just where you need it, in the exact amount you need, through a tiny flexible tube with new "Crown" Pulse-Lube . . .

All these "Crown" developments are detailed and described in a new, comprehensive "Crown" catalog (our Bulletin 0400-B1). We'll be happy to send you one.

PARKER HANNIFIN CORPORATION

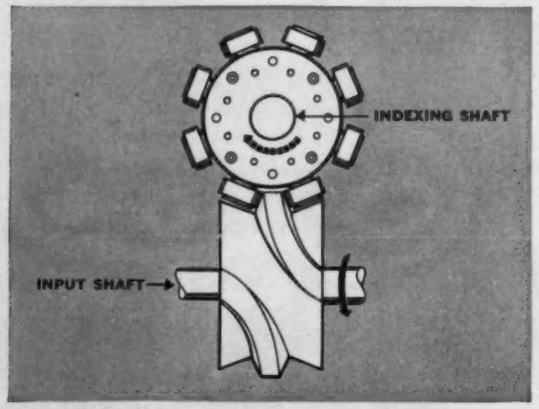
HANNIFIN COMPANY
A DIVISION
535 South Wolf Road • Des Plaines, Illinois
PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS
EUROPEAN DIVISION • PARKER-HANNIFIN N.V. • SCHIPHOL • THE NETHERLANDS

3071-PH

Circle 112 on Reader-Service Card for more information

How Ferguson *ELIMINATES BACKLASH* in Index Tables

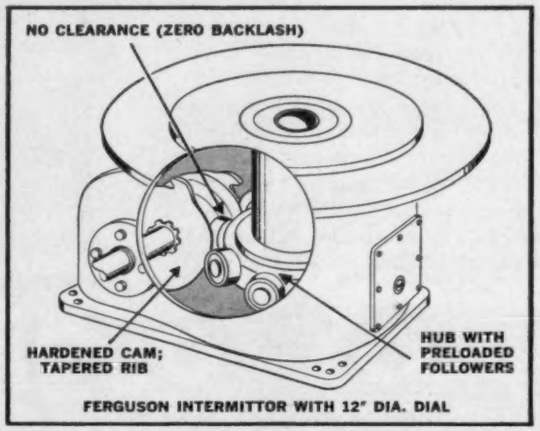
Backlash in indexing results in shock loads that affect the efficiency of a machine and the quality of its product. Most indexing mechanisms have inherent characteristics that cause backlash and poor dynamic conditions and prevent the designer from taking full advantage of modern feeds, tooling and methods that contribute to production economy.



Ferguson Intermittor Index Tables have inherent zero backlash and extreme precision which results in a rotary transfer machine base capable of operating speeds up to 500 indexes a minute. *A Ferguson index table never proves to be a limiting factor in the speed or performance of an automatic assembly machine.*

HERE'S WHY: The continuously rotating cam of a Ferguson indexing mechanism features a *tapered rib* along which two preloaded bearing followers roll, maintaining constant contact with no clearance between them and the rib. When the mechanism is in the rest, or dwell, position, a straight portion of the rib locks the followers with zero backlash and an indexing accuracy of .001". Wear on the hardened tool steel cam is infinitesimal (many have been in use for more than 25 years). Followers are rated for a minimum of 8,000 hours operation. If backlash occurs after this period the life of the drive may be renewed merely by replacing the standard followers.

NOTE HOW PRELOADED FOLLOWERS ENGAGE RIB



FERGUSON INTERMITTOR WITH 12" DIA. DIAL

Compare this with other types of indexing devices. A geneva drive, with its slotted wheel and driver, and a barrel cam with a grooved track which engages one follower at a time, must have clearance in the slot or groove to allow passage of the follower. The slightest amount of clearance causes backlash. As the slot or groove wears, the clearance becomes greater and the backlash condition worsens. At the higher, more profitable operating speeds poor dynamics cause wear on other parts of the machine. The user must choose between frequent downtime for repairs or slower speeds . . . He is the loser in either case.

FREE DESIGN DATA — Load ratings, dimensions and application and installation information about standard and stock Intermittors, Ferguson Drives and in-line machines are contained in a single 36 page catalog. Every designer should have one in his library . . . Write Ferguson—Ask for Catalog No. 160.

FERGUSON
MACHINE COMPANY
A Division of Universal Match Corporation
7818 Maplewood Court • St. Louis 17, Missouri

Circle 113 on Reader-Service Card for more information

Resistance Wire 358

New standard limits for temperature coefficient of resistance of ±5 ppm per deg C for fine resistance wire are available in sizes 0.00275 inch and finer. The TCR wire represents a 50-percent improvement over previous industry standard of ±10 ppm. Wire in all sizes, 0.00045 to 0.010 inch, has a substantially improved stability of resistance. Improvement in linearity is another feature of this alloy wire. Field tests have shown that "KARMA" now has a linearity variation not exceeding 0.002 percent in 500 ft. Individual spools will not vary more than one percent.

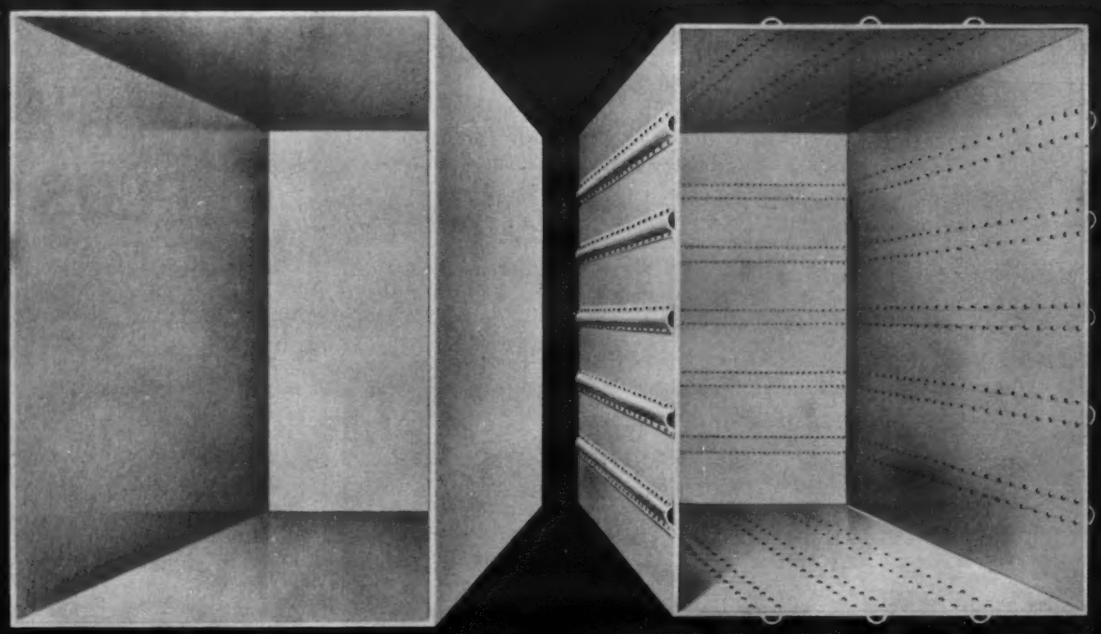
Driver-Harris Co., Harrison, N. J.

Epoxy Adhesive Cement 359

An epoxy adhesive is produced with a special curing agent that results in clear, transparent bonds, particularly useful in cementing glass and ceramic parts. "Rez-N-Glue EP-F" is a two-component adhesive in which parts A and B are blended in equal quantities. Blending forms a free-flowing resin that is dispensed readily from paper cups or other convenient containers. The adhesive cures fully at room temperature in 24 hr.

Schwartz Chemical Co., Inc., 50-01 Second St., Long Island City 1, N. Y.

Circle 114 on Reader-Service Card



NO-RIB RIBBED

Thick-gauge magnesium sheet is so rigid that time-consuming rib stiffeners and fasteners are eliminated. Yet the magnesium panels are light and strong, resist dents and punctures better than thin-skinned ribbed construction.

WHICH HIGH-STRENGTH DESIGN WEIGHS LESS... COSTS LESS TO BUILD?

Magnesium no-rib, of course. By increasing the sheet thickness slightly, designers of containers and vehicle bodies get a tremendous boost in rigidity, thus can eliminate stiffening ribs. And since magnesium is the lightest structural metal, the resulting unit weighs less than conventionally-designed structures using other metals. (No-rib design in other metals introduces a severe weight penalty.) Magnesium no-rib structures are smooth-walled, minimize crevices for water seepage, have greater cubic capacity pound-for-pound than ribbed units. For detailed information on using magnesium no-rib construction for fabricated units of all types, write THE DOW METAL PRODUCTS COMPANY, Merchandising Department 1108AV4-10, Midland, Michigan.

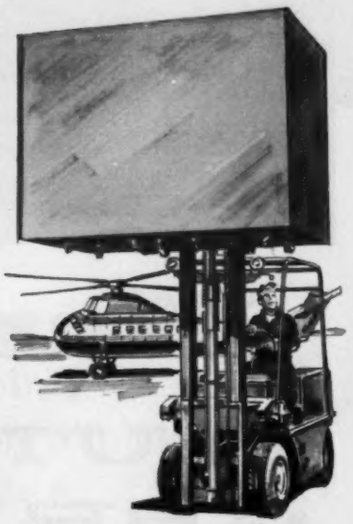
DOW

THE DOW METAL PRODUCTS COMPANY

Division of The Dow Chemical Company

DOW

HOW MAGNESIUM NO-RIB DESIGN CUTS CONTAINER COSTS AND WEIGHT



Cargo containers can be made both strong and light . . . and at less cost . . . with magnesium no-rib design. Fabricated from stiff sheets of lightweight magnesium, container walls need no stiffening ribs or supports.

No-rib design eliminates costly, time-consuming installation of ribs and fasteners . . . provides strong, dent-resistant walls that are smooth inside and out . . . produces economical containers that, pound-for-pound, have greater cubic capacity than ribbed containers of any other metal.

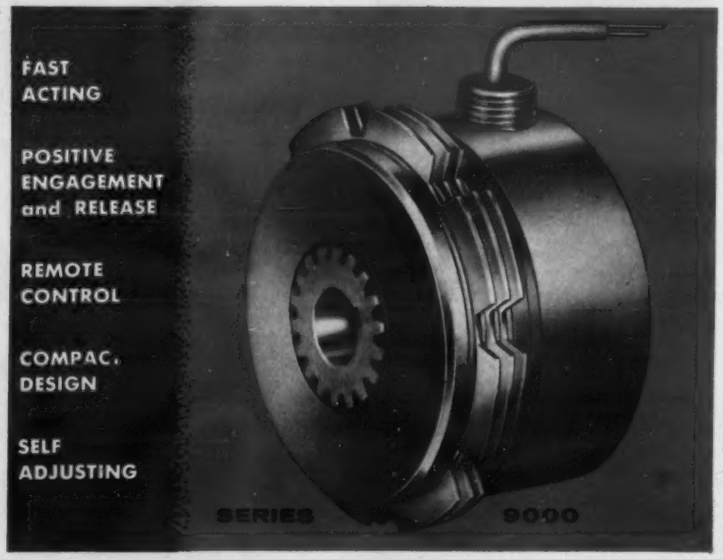
Dow magnesium sheet alloy ZE10A is ideal for no-rib construction. It provides high welded-joint strength and *needs no stress relief* after welding. For equipment handling and cargo containers, storage bins, vehicle bodies, magnesium no-rib construction offers maximum strength at lightest weight . . . and savings in construction time and costs!

DOW

THE DOW METAL PRODUCTS COMPANY

Division of The Dow Chemical Company
Midland, Michigan

IDEAL FOR AUTOMATED MACHINES



Maxitorq

ELECTRIC

CLUTCHES and BRAKES

Incorporating advanced design principles proved through years of service, the MAXITORQ Electric Clutch is well adapted to all types of machine drives. Simple in design . . . built to machine tool standards . . . requires no adjustments, can be used either as a clutch or brake. Disc separators not only separate discs, but also break up residual magnetism and result in extremely fast, positive action with no drag or heating in neutral. There are few moving parts. Electrical operating unit remains stationary — hence, no troublesome slip rings, brushes, or difficult wiring problems. Operation is on standard 100 V d.c. Other voltages on special order.

If you have a clutch or brake application where you are looking for NEW and IMPROVED performance, we invite you to bring the problem to us. Phone, wire, or write Dept. DN for Bulletin No. 90.

SPECIAL FEATURES

- Engaged entirely by magnetic flux.
- Operate either on-off or by varying voltage for torque control.
- NO troublesome slip rings or brushes.
- NO levers, cams, or other highly stressed mechanical parts.
- Operation is not dependent upon rotation.
- Finished complete, assembled, and ready to install on shaft.

THE CARLYLE JOHNSON MACHINE CO.
MANCHESTER, CONN.

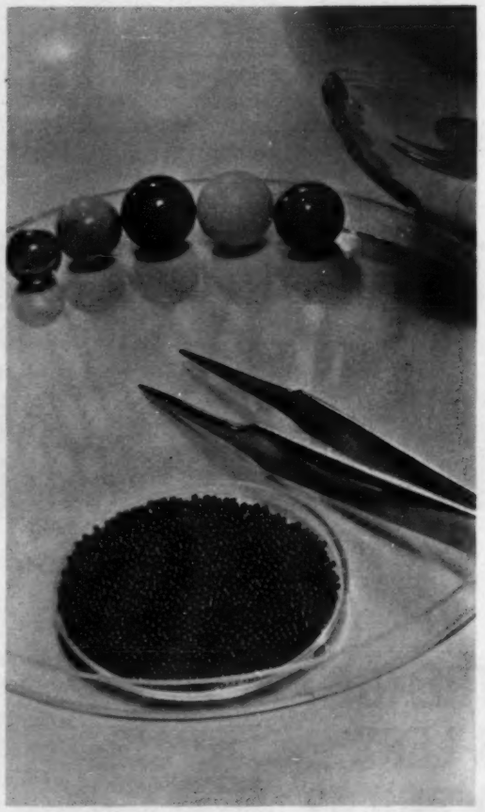
ICJ61

Circle 115 on Reader-Service Card for more information

MATERIALS

Precision Spheres 360

Precision spheres of special materials are offered in both prototype and production quantities. Among the materials are boron carbide, titanium diboride, glass-filled "Teflon", Indox I, irradiated polyethylene, ferrites, synthetic rubies and sapphires, tantalum, titanium carbide and high-density aluminum oxides. Spheres of these materials extend the range of possible applications in cases where temperature and load extremes, corrosion resistance, magnetic or nonmagnetic qualities, dielectric properties or controlled density are of major importance. Balls of high-purity metals for research and development purposes can be furnished in a wide range of sizes, tolerances and surface finishes.



Industrial Tectonics, Inc., Technical Services Dept., 3686 Jackson Rd., Ann Arbor, Mich.

TUBING QUALITY ...PLUS

● Quality in small tubing starts with the careful selection of redrawing stock. It must be of the correct analysis and free of flaws throughout.

Next, quality depends on applied know-how. UNIFORM's craftsmanship meets extremely close tolerances on O.D., I.D. or wall dimensions—down to ±0.00025 inches. UNIFORM's skill provides fine finish, exact temper, square-cut ends free of burrs or distortion, and perfectly straight tubing protected during shipment by modern packaging. Then, if tubular parts are to be fabricated "at the mill," tubing quality is maintained through unusual ingenuity in the design and construction of special jigs, fixtures and production equipment providing intricate conformations with precision.

Quality is paramount at UNIFORM TUBES. Whether you need tubing to meet standard specifications or have special requirements, come to UNIFORM for the answer in both tubing and fabricated parts supplied in many alloys of steel, copper, nickel, aluminum and the precious metals. Send us your specifications for quotation.

UNIFORM TUBES, INC. COLLEGEVILLE 2, PA
HUxley 9-7276 TWX-CGVL 1044

Circle 116 on Reader-Service Card

'Teflon' Tubing 361

Made for use as slip-on insulation, this tubing offers high reliability with a combination of properties that include thermal stability at higher current loads, extreme toughness at low temperatures and superior dielectric strength. Additional advantages are unusual weathering characteristics, complete chemical inertness and thermal resistance to withstand soldering temperatures. Tubing is made in 11 colors for circuit color coding and three different weights with sizes ranging from AWG No. 30 to No. 0.

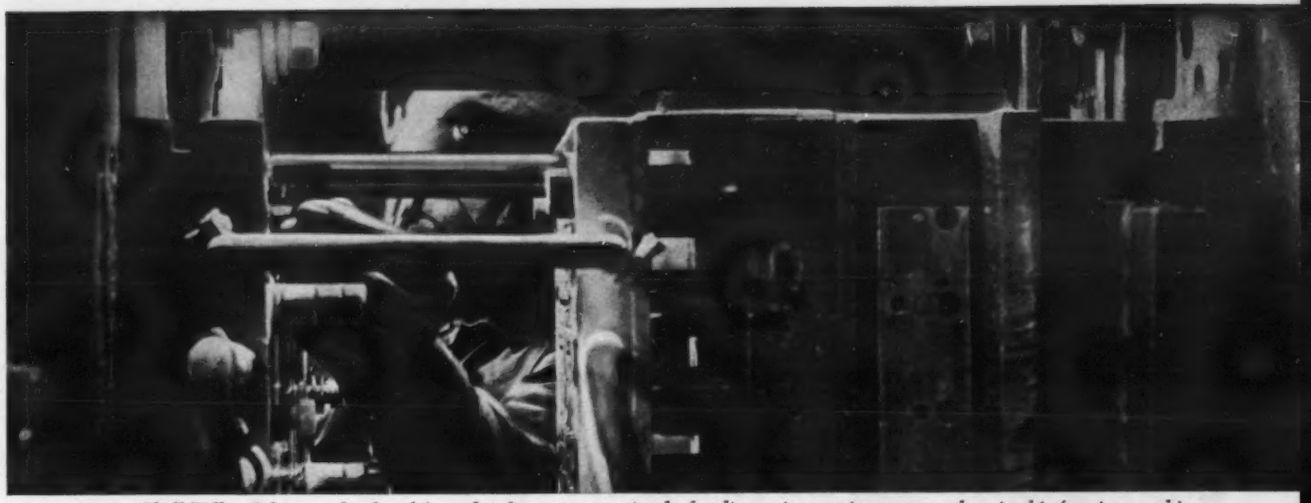
Chemplast, Inc., 3 Central Ave., East Newark, N. J.

Epoxy Silver Solder 362

A silver conductive epoxy with a resistivity approaching the resistance of metals—between 0.01 and 0.0001 ohm-centimeter—has two principal advantages over conventional solder or brazing. It can be used at low temperatures for components which are heat-sensitive and it has no flux or residue to contaminate sensitive electronic components. Solder is available in two paste forms—a one-component, heat-curing (as low as 125C) paste; and a two-component, room-temperature-cure paste. It is ideal for field repair work, particularly on crowded printed circuits where solder temperatures might damage heat-sensitive components. Shear strength of a steel-to-steel bond is 3200 psi.

Epoxy Products, Inc., Div. of Joseph Waldman & Sons, 137 Coit St., Irvington, N. J.

Circle 117 on Reader-Service Card



Shell Tellus Oils are refined and formulated to meet exacting hydraulic service requirements, such as in this forming machine.

PHOTO COURTESY ATLANTIC PLASTICS INC., STAMFORD, CONNECTICUT

BULLETIN:

Shell provides a quick 6-point check list for hydraulic oils: Use it to pick the right oil for your needs

Selecting the proper hydraulic fluid for your equipment can be one of your most important decisions. And it can pay off in many ways. Less down time. Lower cost per unit. Longer equipment life.

Here are six bench marks to help you pick the best hydraulic oil for your plant requirements.

1. Does it have good oxidation stability? Oxidized hydraulic oil can form gums, lacquers and other deposits which may foul moving parts. Shell Tellus Oils are carefully refined to remove unstable, sludge-forming components, then fortified with a Shell-developed oxidation inhibitor.

2. Will it resist foaming and emulsification? Pump chatter and erratic operation are often the result of pump cavitation, brought on by oil foaming. Tellus® Oils contain powerful additives to help prevent foaming.

They also contain a selected inhibitor to combat effects of moisture that might be in the system.

3. Does it fight rust and corrosion? It is difficult to exclude all moisture from a hydraulic system. And moisture can form troublesome rust. Shell Tellus Oils have been carefully compounded to resist corrosion.

4. What are its lubrication qualities in continuous service? Shell Tellus Oils form a clinging, oily film on mating metal surfaces. This maintains a constant guard against wear.

5. How does it react to temperature changes? This is a key factor in the performance of hydraulic equipment. Careful selection of the proper viscosity grade of Tellus assures satisfactory operation of your system over its entire temperature range.

6. Is it available in several viscosity grades? Shell Tellus Oils are available in a broad range of viscosity grades. There's a special grade for virtually every hydraulic requirement.

Ask your Shell Industrial Products Representative for facts on Tellus Oils. Or write: Shell Oil Co., 50 West 50th St., New York 20, N. Y.

A message to manufacturers of hydraulic equipment

There is a Shell Tellus Oil suited for your equipment.

1. Your customers can get Tellus Oils at Shell depots everywhere. Readily available throughout the world.

2. Quality is consistently high. Tellus always delivers top performance.

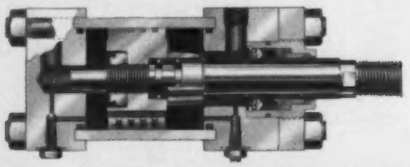
SHELL

A BULLETIN FROM SHELL
—where 1,997 scientists are working to provide better products for industry

EXCLUSIVE WITH CARTER!

ROD SCRAPER *PLUS* ROD WIPER AS STANDARD

J. I. C. Interchangeable SQUARELINE Series features a Metal Rod Scraper *plus* a Rod Wiper in a quick change Cartridge—*Double protection* against chips, dirt, damage. Unitized cartridge rod bearing . . . easy removal and replacement . . . no cylinder disassembly necessary!



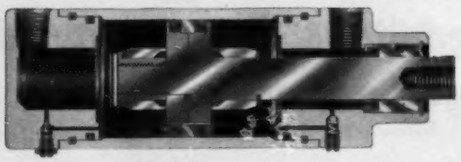
SQUARELINE 2000-3000 PSI HYDRAULIC

- 1½" to 12" bore
- 100% JIC interchangeable
- True cushion-automatic concentric alignment
- Positive piston locknut design
- Delivery from stock!

THE COMPLETE LINE

CARTER FLUID POWER

ROUNDLINE AIR-HYDRAULIC



- Space saving designs! Light weight!
- Full 1 to 1 Meehanite cartridge rod bearing.
- Precision honed heavy wall tubing—6 to 1 safety factor.
- Spring loaded "V" packing on rod end gland.
- Key type stainless steel locking ring. Allows 360° orientation of pipe ports.

ROTARY TORQUE ACTUATOR PNEUMATIC-HYDRAULIC

- New design opportunities
- To 370° rotation as standard
- Safe, powerful torque
- Air, oil, gas, water operation
- Zero leakage

STANDARD ROTATIONS

0-100°	0-280°
0-190°	0-370°

IMMEDIATE DELIVERY ON ALL STANDARD CYLINDERS AND ACTUATORS

SEND FOR MASTER CATALOG

Complete bound file. Air and hydraulic cylinders. Rotaries, clamp cylinders, air valves, and the new SQUARELINE. Complete details and prices. SEND TODAY.

CARTER CONTROLS INCORPORATED

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Phones: BAyport 1-7186 (Chicago) GRanite 4-3305 (Lansing)

TELETYPE LNSG, MI 1119

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Torque Screwdriver Kit

363

A complete line of torque screwdrivers and wrenches features two micrometer-adjustable torque devices. One driver offers a torque range from 4 to 100 oz-in and the other a torque range from 2 to 30 lb-in. Also available with the kit is a complete set of adapters for driving regular hex nuts, socket-head screws, regular screws and Phillips screws. Screwdriver-type models are obtainable in preset as well as micrometer adjustables.

Hunter Tools, 9851 Alburtus Ave., Santa Fe Springs, Calif.

NOW! new economies in NYLON GEARS means savings in gear costs up to 90%

Our many years of successful production of Nylon Gears can now make even greater economies for you. With the great variety in molds now possible, Nylon should not only be considered as an economy measure but the answer to many problems where compact design is necessary. Nylon Gears are quiet, durable, efficient and need less lubrication—they mate perfectly with metal gears.

Let our engineers with more than a decade in gear experience consider your gear problems DURING the design process—send blueprints or specs for prompt estimates.

Gears made only to your specifications. None carried in stock.

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PROCESS GEAR CO., INC.

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HIGH TORQUE

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Heinze Universal Motors provide high starting and/or high running torque for blenders, mixers, meat slicers, can openers, vacuum cleaners, and similar applications.

In addition, Heinze Universal Motors are rugged to withstand rough use, compact to fit limited space, versatile to allow all types of mounting arrangements and modifications, uniform in quality, keyed to high production, and are competitively priced.

Standard voltage rating is 115V AC/DC but motors are supplied for other voltages.

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Sub-Fractional Horsepower Motors and Blowers

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Please send catalog on Heinze Sub-Fractional Horsepower Motors and Blowers.

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Engineer's Drawing Table 364

This table incorporates a drawing-board cabinet on one side and a drawer cabinet on the other. The cabinet has seven drawers with recessed handles—each with its own built-in lock for safe storage of drawing equipment. Drawing-board cabinet has separators for storing seven boards plus a book-storage compartment. The table has a smooth steel top with flange on front edge to hold drawing board in place. Angle of top is adjustable every inch with wing nuts. The table is available as a complete unit or component parts may be ordered separately. Finish is gray baked-on enamel. Overall size is 45½ inches wide, 26 inches deep and 36 inches high.

Lyon Metal Products, Inc., 5 Plant Ave., Aurora, Ill.

Explosive Tester 365

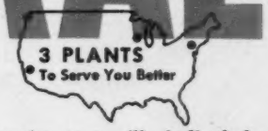
Model IRB-111 impulse resistance bridge tests propellant or cartridge-actuated devices in missile launch, separation or destruct packages. When operating handle of the device is depressed, a single sensing pulse is applied for about one millisec in duration. Instrument is completely encapsulated for maintenance-free operation and requires no lubrication. The unit can be used in aircraft electrical check-out and by industrial laboratories and manufacturers for testing with complete safety any device in which heating effects may be undesirable, harmful or dangerous.

Fleming Industries, Inc., 2433 Moreton St., Torrance, Calif.

"Who's best with PERSONAL SERVICE on short run stampings?"

FEDERAL

SHORT RUN STAMPINGS



Freddy Federal says: "Our skilled estimators will gladly help you with stamping tolerance or design problems and make suggestions for cutting cost or improving quality. Whenever possible, stock Federal tools and fixtures are used *without charge to you.* Experienced craftsmen with a deep personal interest in meeting your stamping specifications will use step-by-step inspection procedures. Most parts are deburred *without cost to you.* Your order is shipped the same day it is finished. Dies are stored for your exclusive use. Send your part or print today for airmail quotation. Time short? Ask for reply by phone or wire. It's another Federal personal service!"

Let us send you our illustrated Catalog No. 301 with its many stamping design tips.

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No. Hollywood, California

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HANDY ALLOY DATA SHEET

HANDY & HARMAN ENGINEERING DEPARTMENT
82 FULTON STREET, NEW YORK 38, N.Y.

TEC and TEC-Z

...How to choose between a soft solder and a brazing alloy

Handy & Harman provides *two* alloys that fit between "something stronger than the average soft solder but not as strong as a silver-brazing alloy." They are named TEC and TEC-Z and their flow points are intermediate between soft solders and silver-brazing alloys. Joints made by these alloys are strong in straight tension or shear. For instance, butt joints of cold-worked copper can be made having a tensile strength of about 25,000 psi. This is approximately 10,000 psi. more than can be obtained with tin-lead soft solders. TEC joints retain their strength at elevated temperatures much better than the tin-lead soft solders. As shown in the table below, the strength of the solder itself at 425° F is about the same as a 50% tin–50% lead solder at room temperature in short-time tensile tests.

Applications—One example is a thermostatic bellows where the operating temperature is too high for soft solders (tin-lead), yet requires a joining medium which will not anneal the bellows. Another use is gun parts which require joint strength at higher than soft-solder operating temperatures *plus* corrosion resistance to solutions used in cleaning and blackening. Also for lamp bulb bases operating at approximately 350°-500° F. Automotive applications and heat exchangers. TEC conforms to Government Specifications Mil-S-19234 (Nord); both TEC and TEC-Z are available in sheet, wire, powder, and preforms to specifications.

NOMINAL COMPOSITIONS

	TEC	TEC-Z
Silver	5% plus or minus 0.5%	5% plus or minus 0.5%
Zinc		16.6% plus or minus 0.5%
Cadmium	95% plus or minus 0.5%	78.4% plus or minus 0.5%

PHYSICAL PROPERTIES

	TEC	TEC-Z
Color	White	White
Melting Point	640° F	480° F
Flow Point	740° F	600° F
Density (Troy oz/cu in.)	4.60	4.53
Electrical Conductivity (Cu=100)	22.0%	20.6%
Electrical Resistivity (Microhm-cm)	7.9	8.4

STRENGTH COMPARISON TEC vs. Pb-SN

	TENSILE STRENGTH LBS/SQ IN. TEC	TENSILE STRENGTH LBS/SQ IN. Pb-SN
ROOM	16,400	2,500
300° F	4,400	650
425° F	2,600	Melts
500° F	1,700	

The information and data on this page are available in our Handy Alloy Data Sheet. Ask for "TEC." Handy & Harman, 850 Third Ave., New York 22, N. Y.

Your No. 1 Source of Supply and Authority on Brazing Alloys

HANDY & HARMAN

General Offices: 850 Third Ave., New York 22, N. Y.

Offices and Plants: Bridgeport, Conn. • Chicago, Ill. • Cleveland, Ohio • Dallas, Texas • Detroit, Mich. • Los Angeles, Calif. • New York, N.Y. Providence, R. I., • Montreal, Canada • Toronto, Canada

DISTRIBUTORS IN PRINCIPAL CITIES

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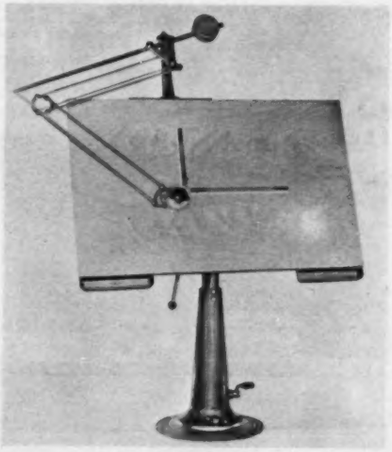
EQUIPMENT

Fastener Kit 366

Commonly used but hard-to-buy washer-head sheet-metal screws are now available in a handy assortment. A "Skru-Box" assortment of eight sizes of slotted hex-head type of washer-head sheet-metal screws, type A, is individually compartmented in a handy, clear-plastic hinged box. All screws are cadmium-plated to prevent rust and include sizes No. 6 by ¼ inch, No. 6 by ⅜ inch, No. 6 by ¾ inch, No. 6 by ½ inch, No. 8 by ¼ inch, No. 8 by ½ inch, and No. 8 by ⅝ inch.

Waldom Electronics, Inc., 4625 W. 53rd St., Chicago, Ill.

Drafting Table 367



The "Nike" hydraulic drafting table fits into the smallest space requirements for a full-sized drafting board. Vertical traverse is nearly 2 ft. Angle adjustments range from horizontal to vertical and board can be rotated freely 360 deg around base. The board can quickly change positions to create special spaces within drafting rooms and can turn for use as right-angle reference to other boards. Entire apparatus is stable without floor attachments; a low center of gravity permits free placement. A system of hole vents on edges of boards provides moisture equalization throughout interior of lattice-work core.

Isis, Inc., Box 1062, York, Pa.

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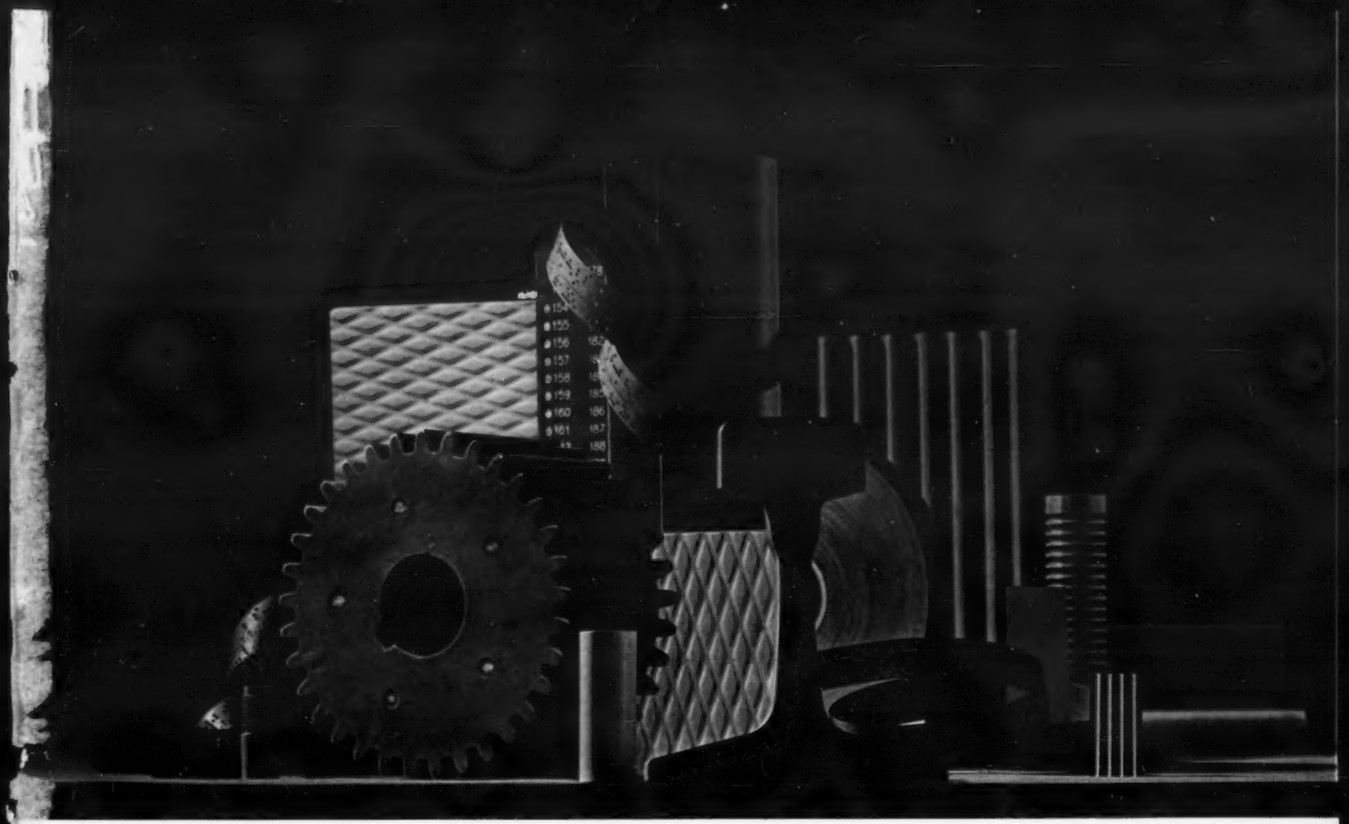


THIS remarkable plastic may trigger a new (or cost-saving) design idea for you

National Vulcanized Fibre is unique. It's a tough, cellulosic plastic—not mere paper or fiberboard. Vulcanized Fibre possesses an unusual combination of mechanical, electrical and thermal properties. For example . . .

It weighs one-half as much as aluminum, yet is one of the strongest materials known per unit of weight. It's tough, durable and cushions the shock of repeated blows.

Vulcanized Fibre has superior arc-resistance. It comes in standard and special grades, including a fire-resistant grade called "Pyronil." It can be machined, formed or deep-drawn into intricate shapes, and can be combined with other materials . . . aluminum, rubber, "Mylar," copper, laminated plastic, plywood, to name a few.

You can polish it, paint it, lacquer it, emboss it. And regardless of the finish, it resists oils, gasoline, fungi, most solvents. Most surprising is its low cost.

Find out for yourself why National Vulcanized Fibre is "the plastic with a million uses." There's a free sample kit waiting for you at a nearby NVF sales office. Check Sweet's Product Design File 2b/Na for the one nearest you. Or write directly to Dept. RR, Wilmington, Delaware.

116 Choices: One Source This is the latest count of the different plastics and grades NVF can offer in your search for the *one best material*. Add to this total *the* one special grade that can be developed from scratch to meet your particular need. This full range of materials is backed by complete engineering services . . . from application assistance up to and including the delivery of 100% usable, precision-fabricated parts . . . in any quantity, on time!

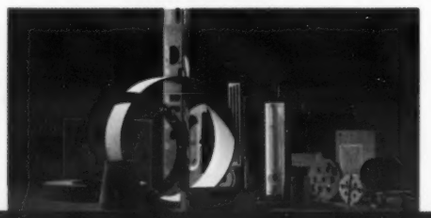
Call the NVF Sales Office near you. It's a direct line to single-source help on your current materials problem.

NVF

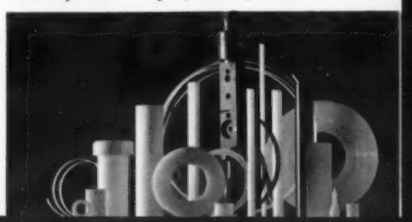
NATIONAL VULCANIZED FIBRE COMPANY
WILMINGTON 99, DELAWARE
In Canada: NATIONAL FIBRE COMPANY OF CANADA, LTD., Toronto 3, Ontario

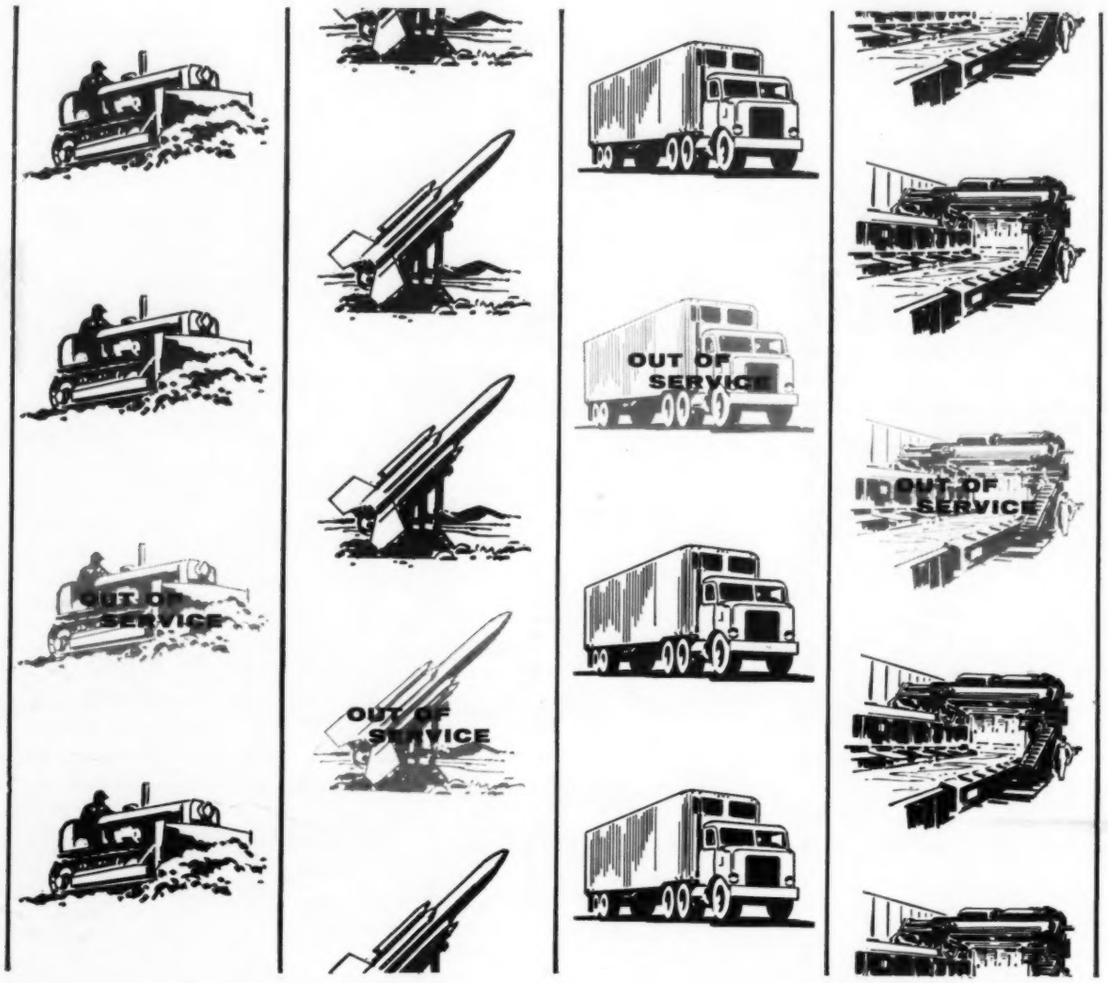
5 grades of polyester

85 Phenolite® laminates



3 thermoplastics . . . nylon, Delrin®, Penton®





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help keep your down-time low

When a bearing "goes", your machine stops.

That's why it pays to call in Rollway. Especially when reliability is a must.

At Rollway, you can choose from a wide selection of sizes and types with maximum capacities . . . for normal, low or high temperature operation. All meeting or exceeding RBEC requisites in Classes 1 to 5.

You'll find that Rollway meets your needs exactly – in commercial grade, precision, or ultra-precision bearings. To get the bearing you want in a hurry, or to start R and D on the bearing you've been dreaming about, just call or write Rollway Bearing Company, Inc., Syracuse 1, New York.

Where So Much Depends on So Little . . . You can depend on

ROLLWAY BEARINGS

Radial and Thrust Cylindrical Roller Bearings

ENGINEERING OFFICES: Syracuse • Boston • Chicago • Detroit • Toronto • Pittsburgh • Cleveland • Seattle • Houston • Philadelphia • LosAngeles • SanFrancisco

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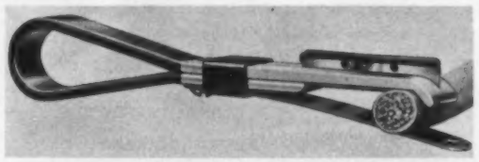
Cable-Cutting Tool 368



Cable tool No. N-2060 is designed for ring-cutting the sheathing of "inside-type" plastic-fabric or rubber-covered cable. Operation is simple. Cable is pushed into tool and against spring. Back pressure holds cable against cutting blade. Accurate 0.03125-inch-deep cut is made when tool is rotated around circumference of cable. This device is suited for customary 3/16-, ¼- ⅜- or ½-inch cables and will handle thin sheathed cable up to 1 inch in dia. Cuts are always 1/32 inch deep in each instance. Cable-sheath slitter No. N-62267, for slitting cable lengthwise after circular cutting, is also available.

P. K. Neuses, Inc., 511 N. Dwyer St., Arlington Heights, Ill.

Four-Track Tape Deck 369

A stereo/mono four-track tape deck for professional and home use includes such features as 14-transistor playback, amplifier and record electronics, with separate push-pull bias-erase oscillator and full-wave rectifier, a hysteresis synchronous capstan drive motor and two heavy-duty, four-pole induction-reel motors. There are only three mechanical linkages in the transport mechanism. Each head is provided with a four-point professional mount and record play heads have laminated mu-metal core pieces, interchannel mu-metal shielding and mu-metal outer shielding. Use of separate record and playback heads and amplifiers permits off-the-tape monitor and selected sound-on-sound operation without changing connections. Heads and guides are on a common detachable base plate. Tape guides are precision machined to ±0.001 inch to all but eliminate tape weave. Frequency response at 7½ ips is 30-15,000 ±2 db, noise is 55 db below maximum recording level and wow and flutter are 0.2 percent; at 3¾ ips the frequency response is 30-10,000 cps ±2 db, wow and flutter are 0.25 percent.

Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, N. Y.

Are your bookkeepers better equipped than your engineers or draftsmen?

You certainly want your bookkeeping department to have the latest equipment to maintain accuracy and output—but your highly trained professional engineers or draftsmen need today's tools, too—for the high production efficiency you've a right to expect.

Your draftsmen, your productivity, deserve new Hamilton space- and time-saving equipment from Post

Inefficient, obsolete equipment in your drafting department may be *stealing dollars* from you every working day! Top professional draftsmen work better, work smarter, make fewer errors when they use premium-quality Hamilton equipment. Boosts morale, too! Watch *your* top men respond to the professional challenge of smart modern Hamilton units engineered to fit your needs. Learn why thousands of firms have selected Hamilton year after year . . . call our designers for planning help without obligation, of course.

HAMILTON L-CONTOUR TABLE Sturdy, counter-balanced drawing surface travels full 20"—permitting frequent position change, greatly reducing fatigue—quickly adjusted to individual requirements for each individual job. Board completely stable in all positions, horizontal to vertical. Modular construction permits arrangements to suit specific needs—right or left reference desk position optional. Ruggedly made, durably finished with long-life drawing and reference surfaces.

Hamilton Unit System Files
Provide full protection, accessibility, and classification for all materials to be filed. Occupy minimum floor space.

Hamilton Auto-Shift Table
Built-in mechanism adjusts board to individual height and slope requirements, provides full accessibility, reduces errors.

Hamilton CL 100 Drafting Table
Conserves dollars, yet rugged canted-leg design provides modern styling and convenience with long-term durability.

For practical, down-to-earth help in solving your drafting room modernization problems, consult trained POST salesmen and dealer representatives for recommendations tailored to your needs. Or, write Frederick Post Company, 3650 North Avondale Avenue, Chicago 18, Illinois, for information on the complete line of POST drafting materials and engineering supplies.

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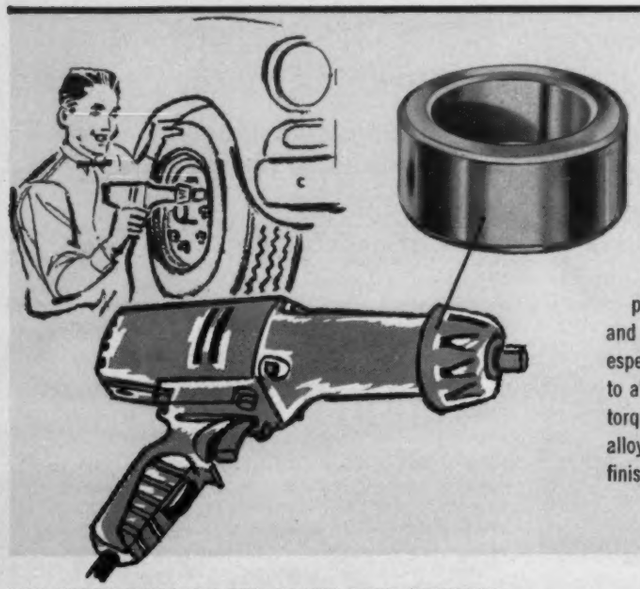
Circle 125 on Reader-Service Card for more information

600 SERIES

THE FORGEABLE BEARING ALLOYS THAT STAND UP ON THE REALLY TOUGH JOBS!

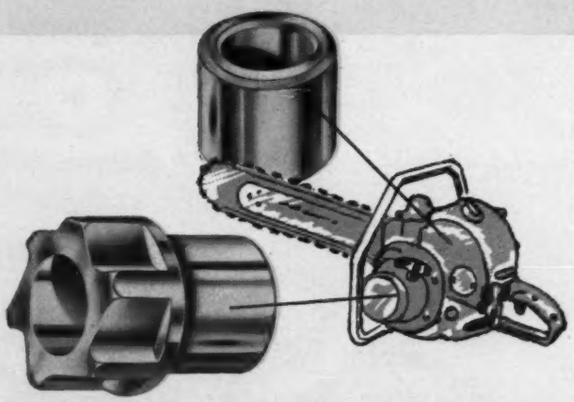


600 ALLOY NOSE BEARING WITHSTANDS THE PUNISHING SHOCK LOADS OF AN IMPACT WRENCH

This heavy-duty impact wrench takes the rigorous punishment of hard industrial use right on the nose . . . and right on the 600 Series nose bearing. This bearing was especially chosen by the manufacturer because of its ability to absorb a range of 1600 to 1800 impacts per minute at a torque of from 0 to 250 foot pounds. By specifying 600 bearing alloy, the manufacturer gets superior performance from his finished product.

600 ALLOY RATCHET AND DRIVE GEAR BEARING TAKES THE TERRIFIC POUNDING OF A HIGH POWERED CHAIN SAW

Professional woodcutters give chain saws a rough time for hours on end, all year round, and these rugged saws must be built to take punishment. With chain speeds up to 3000 feet per minute, the ratchet and drive gear bearings, for example, must have a very high strength, hardness and good resistance to wear with minimum lubrication. That's why 600 Series Alloy was specified for both parts . . . the ratchet is a forging and the bearing was produced from 600 Series rod.



MUELLER BRASS CO. SPECIALIZES IN ALLOYS FOR DIFFICULT APPLICATIONS

For complete engineering data, write today for Special Alloys Kit No. 13.

The alloys available from the Mueller Brass Co. range from those having high hardness and wear properties, to alloys that must possess excellent electrical conductivity, and ones that must have free-machining properties. Let our engineers help you select the alloy best suited to your exact application.

MUELLER BRASS CO. PORT HURON 23, MICHIGAN

326

Circle 126 on Reader-Service Card for more information

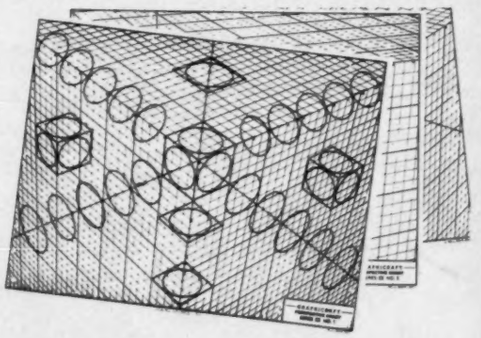
EQUIPMENT

Cable Pressure Calculator 371

This is an instrument for quickly and easily performing the mathematical computations required for cable pressure analysis procedures which are based on the computation of flow and pressure drop. The unit can compute the following: flow (SCFH); pressure drop (psi); reciprocal of a pneumatic resistance, and problems of proportion involving pneumatic resistance, distance, flow and pressure drop. It contains five separate scales. A 20-page booklet, giving detailed instructions for the use of the computer through illustration diagrams and step-by-step text, is furnished with this item.

S & G Mfg. Corp., P. O. Box 1309, New Orleans 10, La.

Perspective Charts 372



Practical data has been added to conventional perspective grids. These underlay charts have zones indicating exact angle at which circles should be drawn at any location on three basic planes of a perspective drawing. Charts are offered in Series II, two-point perspective, and Series III, three-point perspective. Each set consists of three 11- by 14-inch charts with a viewing distance of 30 inches. Photographic accuracy makes them suitable for technically precise drawings as well as freehand sketching and student use. Charts are imprinted on special moistureproof bristol for good durability and resistance to separation from drafting tape.

Graphicraft, P. O. Box 509, Westport, Conn.

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Graham IS THE MOST **ACCURATE Variable Speed Drive**

Now get accuracy of speed set, reset and speed holding over full range — any desired maximum to zero — with the most *positive* of infinitely variable speed drives . . . the GRAHAM. More *positive* than the induction motor that drives it, the GRAHAM gives unequalled speed regulation with change of load, plus built-in overload protection. The GRAHAM offers a wide choice of built-in motors, reducers and controls — pneumatic, electrical and a micrometer type in 4000 graduations for full range.

SEE OUR CATALOG IN SWEET'S PRODUCT DESIGN FILE — DO WRITE FOR COPY

Graham TRANSMISSIONS, INC.

Menomonee Falls, Wisconsin

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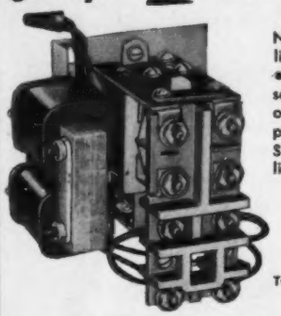
Floatless, Electrode Type

LIQUID LEVEL CONTROLS

give you all these advantages!



No moving parts in the liquid • Easy to install • No adjustments necessary • Unaffected by acids or caustics • Unaffected by pressure or temperature • Standard 2&3 pole units listed by U/L

Write for 32-page Catalog which gives complete specifications

Two pole control shown at left

YOU CAN USE OUR CONTROLS FOR:

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1964 W. Eleven Mile Road, Berkley, Michigan

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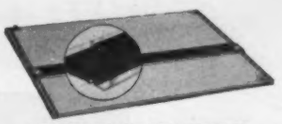
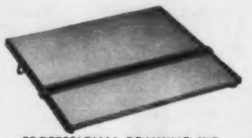


PARALLEL RULING STRAIGHTEDGE

For The Complete Drafting Room

Whether you require straightedges, drawing boards or kits, or any type of drafting table Mayline has a product to meet that need.

Your local dealer can show and tell you all about those products.



PROFESSIONAL DRAWING KIT

8003-C STANDARD

MAYLINE COMPANY, INC.

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SHEBOYGAN, WISCONSIN

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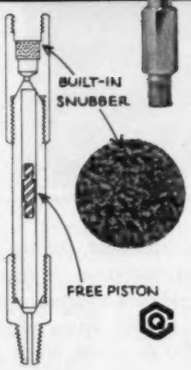
Chemiquip's

a NEW concept in PRESSURE INSTRUMENT PROTECTION WORKER SAFETY

FLOW CHECK SNUBBER



Now, a simple, self-contained, low-cost, foolproof method of protecting valuable instruments . . . preventing the escape of noxious, toxic or flammable gases and liquids in the event of rupture in the pressure instrument system.

- Will withstand pressures up to 30,000 psi
- NEW! Highly accurate, quick-response model for systems from 100 to 5,000 psi
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And, Chemiquip's built-in snubber

- Prevents transmission of line surges and pulsations
- Never plugs or clogs

For greater plant and/or instrument efficiency, for detailed Bulletin J-74, write, wire, phone NOW

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GRamercy 7-3772

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FREE!

BOOKLET AND SAMPLES

LEARN HOW *FASTEX*® *Plasti-Rivets*® CUT ASSEMBLY COSTS!

These ingenious new plastic fastenings drive from one side—simplify blind fastening problems—resist vibration loosening and corrosion. Available in a wide variety of thermo-plastic materials, in a wide choice of colors, sizes and standard or special types.

Send for FREE Testing Samples to-day!

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In Canada: SHAKEPROOF-FASTEX, Division of Canada Illinois Tools Ltd., Toronto, Ont.

A DIVISION OF ILLINOIS TOOL WORKS

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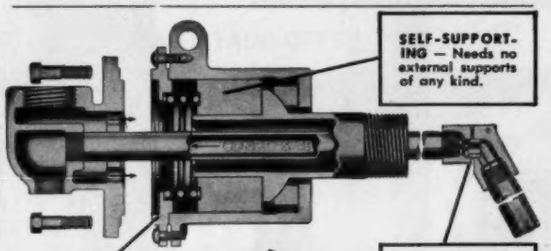
SELF-SUPPORTING — Needs no external supports of any kind.
ASSEMBLY PLATE — Holds internal parts in position when head is removed.
SYPHON ELBOW — Permits use of straight pipe for syphon. Can be inserted or withdrawn right through the joint.

Johnson Rotary Joint with SYPHON ELBOW

Johnson Joints represent the best way industry has yet found to get steam or liquids into rotating rolls and cylinders. They are completely packless, need no lubrication or adjustment. The Type SBP shown gets steam in, condensate out, through the same head. Other types available for through flow service, in sizes to meet all operating needs. ***WRITE FOR COMPLETE INFORMATION.***

The Johnson Corporation

831 Wood St., Three Rivers, Mich.

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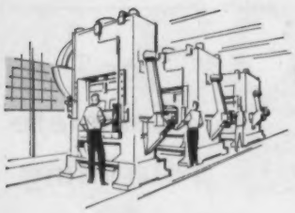
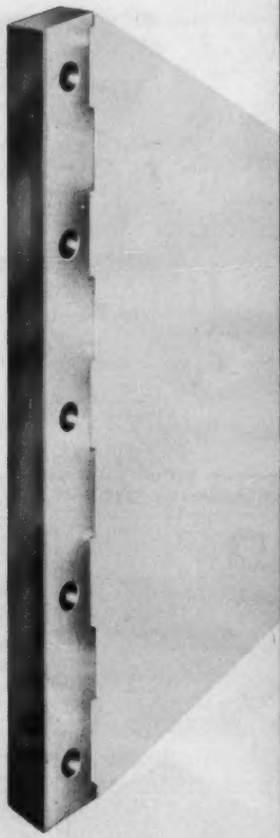
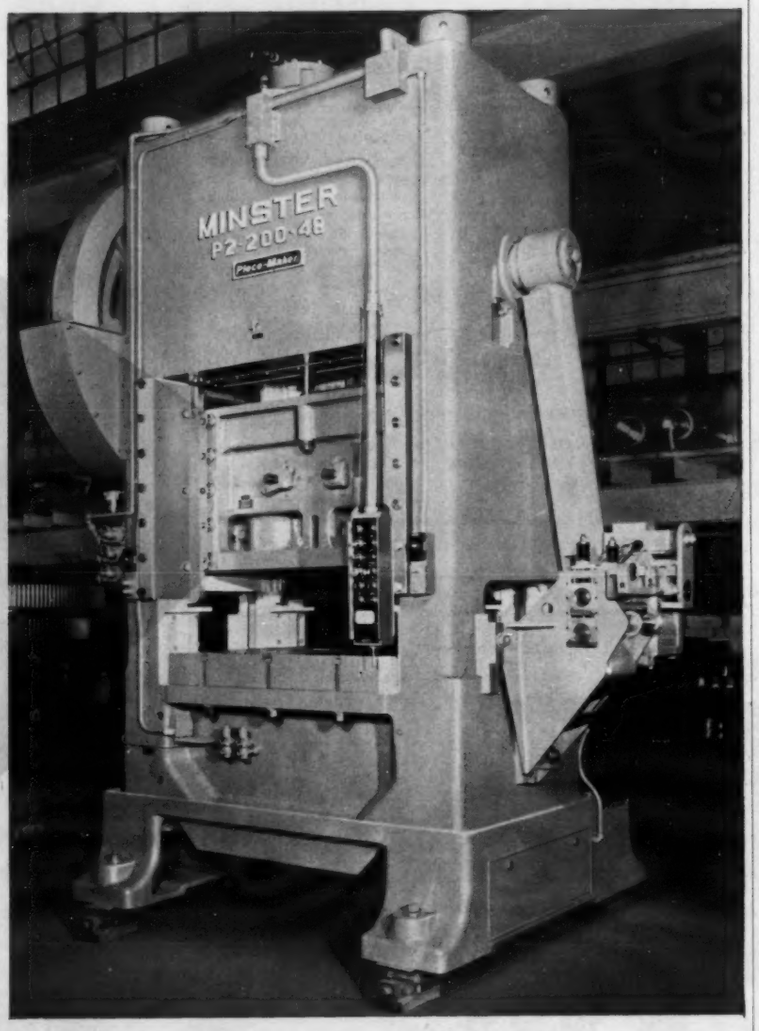


ANOTHER SATISFIED USER





LAMINA-BRONZE
WEAR PLATES

Lamina
DIES AND TOOLS, INC.
P.O. BOX 31, ROYAL OAK, MICHIGAN
Phone JOrdan 6-8711

Lamina-Bronze Wear Plates and their use are more completely described in Bulletin WP-59, send for your free copy.

The adjustable slide ways of this Minster press utilize Lamina-Bronze (electroplated bronze on steel) Wear Plates to assure long-life and free-running. In like manner, Lamina-Bronze wear surfaces are the best answer for any part that requires the non-seizing properties of bronze and the strength of steel.

Circle 133 on Reader-Service Card for more information

EQUIPMENT

IER Test Kit 373

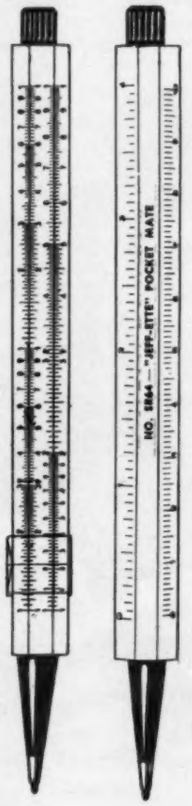
A low-cost testing kit includes a snap-around instrument that measures voltage, amperage and resistance. The complete unit is called the "Amprobe Junior Testmaster". The snap-around tester itself is said to be the only instrument in its price range that measures current without interrupting service, that tests voltage on a calibrated scale and that also measures resistance. Ruggedly

constructed and completely insulated, the device is pocket-sized for one-hand operation (it measures only 4¾ inches in height and weighs 11 oz). Six different models are available: from 0-25 to 0-100 amps; either 0-125/250 or 0/150/600v a-c, and an ohmmeter scale with a mid-range reading of 25 ohms.

Pyramid Instrument Corp., Lynbrook, N. Y.

Slide Rule/Pencil 374

A combination slide rule and mechanical drawing pencil is useful for the engineer, contractor, architect, draftsman, business man and student. Slide rule has A, B, C and D scales on face. Sides of rule incorporate four-inch drawing scale divided into 32nds and a millimeter rule up to 10 cm.



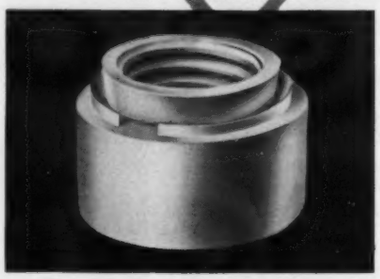
Slide rule functions smoothly and accurately, performing multiplications, divisions, squares and square roots. "Jeff-Ette" is also a smooth-writing mechanical drawing pencil 6 inches long, 7/16 inch wide and ⅜ inch thick, complete with spring pocket clip.

Alvin & Co., Inc., Palisado Ave., Windsor, Conn.

Circle 134 on Reader-Service Card

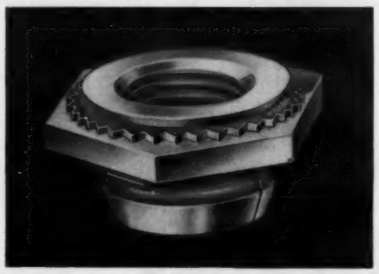
PEM CAPTIVE THREADS for Production Fastening...

THE ORIGINAL SELF-CLINCHING FASTENER



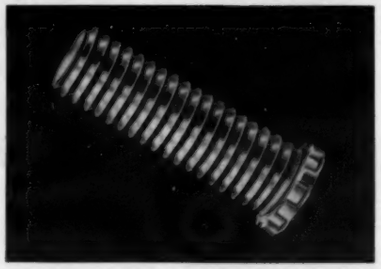
Made in steel, stainless steel, aluminum and Monel. Positively locked into prepared holes by any standard squeezing tool. For metal thicknesses down to .032". Sizes from No. 0 to ¾". Bulletin CL.

SELF-CLINCHING, SELF-LOCKING NUT



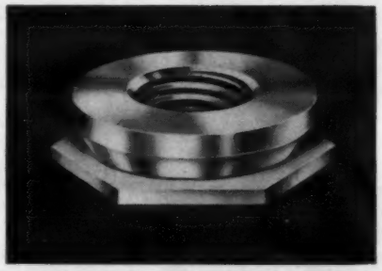
All metal (steel, stainless steel or aluminum) combines 2 functions in single light-weight, low-cost unit for sheet metal fastening. Suitable for installation in sheet thicknesses from .040" and up. Sizes from No. 2 to 10. Bulletin SL.

SELF-CLINCHING CAPTIVE STUD



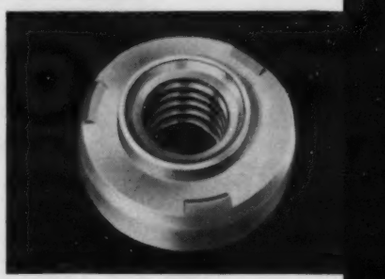
Steel and stainless steel, designed for quick, easy flush-head installation in panels of cold-rolled steel, brass, copper, aluminum alloys and similar materials. Sizes No. 4 to 5/16". Lengths from ¼" to 1½". Bulletin FH.

SELF-CLINCHING FLUSH FASTENER



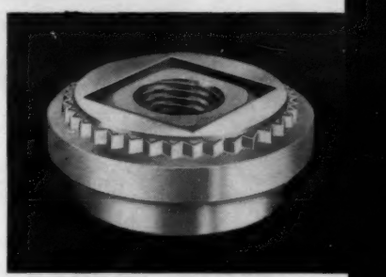
One-piece, stainless steel threaded insert installs in sheet thicknesses from .061" and up with flush mounting area on both sides of sheet. Suitable for materials with Rockwell Hardness of B-70 and less. Sizes No. 2 to ¼". Bulletin FH.

SELF-LOCATING WELD FASTENER



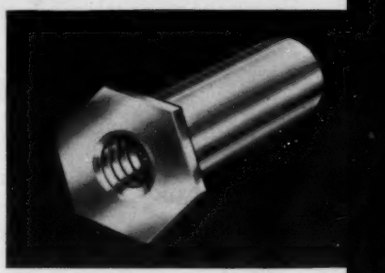
Steel and non-magnetic stainless steel. Nut is projection welded to part with extended shank protecting threads from weld splatter and serving as pilot in assembly. No. 2 to ¼". Bulletin WN.

SELF-CLINCHING FLOATING NUT



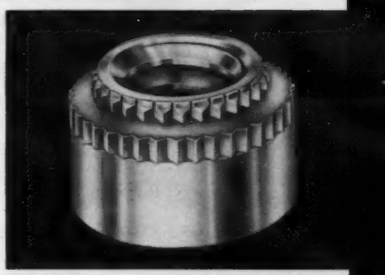
Carbon steel and stainless steel. Provides rapidly assembled nut anchor in sheet metal and compensates for slight errors (up to ½") in alignment of mating holes. Sizes No. 2 to ¼". Suitable for sheet thicknesses from .040" up. Types AS and AC.

SELF-CLINCHING STAND-OFFS



Made in both blind and threaded-through types in steel, aluminum and stainless steel. Sizes No. 4 and No. 6. Overall lengths from ⅛" to 1 1/16". Suitable for use in sheet thicknesses from .040" and up. Bulletin SO.

SELF-CLINCHING SPLINE FASTENER



For hard metals and brittle materials — magnesium, glass laminates, epoxies, etc. Made in steel and stainless steel. Sizes No. 2 to ⅜". Type KF.

PENN ENGINEERING & MANUFACTURING CORP.

DOYLESTOWN • PENNSYLVANIA

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Cylinder ports side and bottom tapped, ⅜, ½ or ¾ in. NPT; through ports tapped both ends and bottom, supply—1 in. NPT, exhaust and wiring conduit ports—1¼ in. NPT; meets JIC Standards.

to save space . . .

to simplify piping and wiring

New PDQ MODULAR MANIFOLD BASE

Now you can save even more space by ganging already-compact Hunt ½ in. PDQ valves on modular manifold bases!

Featuring common supply, exhaust and wiring conduit ports, PDQ modular manifold bases can be ganged end-to-end to manifold two or more valves in a single, compact assembly. Manifolding of valves simplifies supply and exhaust piping, reduces installation costs and minimizes mounting space requirements for multiple valve installations. Modular design permits adding or removing valves at a later date, to meet changing requirements. Also, bottom tapping permits additional supply, exhaust, or wiring connections at any point along the manifold assembly, if required.

Electrical connections, valve-to-base, are plug-in, to reduce downtime to a minimum. What's more, the bayonet-lock construction of Hunt's PDQ valve allows removal and installation of valve and pilot assembly in just 30 seconds, without disturbing piping or wiring.

Whether your problem is limited valve mounting space . . . complex piping . . . high installation costs . . . or you're just looking for better, lower cost, more dependable performance on new or existing equipment, ask your nearby Hunt representative to show you the advantages of modular manifold base-mounted PDQ valves.

For more information, write for Bulletin 602. Address Hunt Valve Company, Salem, Ohio, Dept. DN-461.

HUNT

QUICK-AS-WINK® AIR AND HYDRAULIC

VALVES

HUNT VALVE COMPANY • DIVISION OF IBEC • SALEM, OHIO

3014

Circle 135 on Reader-Service Card for more information

Torque Indicator 375

This torque-indicating system furnishes stabilized excitation for a transducer and a direct reading on panel meter. Transducer's shaft assembly rotates in bore of stationary housing. Shaft, mounted between power and load, acts as torsion spring. When torque is applied to shaft, torsion spring deflects, opening or closing gaps of magnetic armature attached to shaft. Resulting change in reluctance will effect output voltage proportional to torque. The system has approximately 1v d-c

output full scale for recording and control; accuracy is within 2 percent. The unit is powered by 115v, 60 cycles, and indicates remotely at distances up to 1000 ft or more. Temperature range is —65 to 300F, up to 1000F on special order. Transducers are available in any range from 0.1 to 100,000 lb-in and from 0 to 80,000 rpm; maximum overload is 100 percent.

Vinson Mfg. Co., Kavlico Div., 8044 Woodley Ave., Van Nuys, Calif.

NEW

CHIKSAN

LFS SERIES

SWIVEL JOINTS

Rated – 500 psi CWP

● Equally effective on water, hydraulics, fuels or gas lines. Sweep radius minimizes flow turbulence. Bearings are factory lubricated – sufficient, in normal services for the life of the joint. Fabricated from carbon steel. Temperature rating of 225°F – up to 400°F with Viton A packing. Size range is 1½" to 4". For more information, request Bulletin 11-60.

CHIKSAN COMPANY BREA, CALIF.,

61-58 A

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MORE AND MORE USERS ARE STANDARDIZING ON THIS PNEUMATIC REGULATOR

there's a reason!

- ✓ 6500 psi inlet pressure.
- ✓ Eleven outlet ranges from 0 – 5000 down to 0 - 60 psi.
- ✓ Constant outlet pressure regardless of changes in inlet pressure.
- ✓ Integral relief valve — requires no separate adjustment.
- ✓ Temperature range —65°F to +275°F.
- ✓ Low in cost — Immediate delivery.
- ✓ Light Weight (4½ lbs.).
- ✓ Available with manual or electric remote control.

Hi flow — helium, air, nitrogen. Write for detailed information and prices.

BENBOW manufacturing corporation

11920 JEFFERSON BLVD., CULVER CITY, CALIFORNIA

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Machines live longer

... when you make critical replacement parts from handy AMPCO® Stock Products

Ampco copper-alloy stock products outlast ordinary bronze in severe service—sliding wear, extreme bearing pressures, corrosion, and fatigue. You reduce down-time by extending part-life in gears, bushings, nuts, bearings, other parts.

You tie up less money in in-plant inventories. Your Ampco distributor can deliver immediately a full range of sizes in extruded solid rounds, centrifugally cast stock bars, extruded rectangles, sheet and plate, stock die blanks, and guide pin bushings. Rod, sheet, and plate are cut to the exact sizes you need.

Call your Ampco distributor for all your copper-alloy requirements. Write for Bulletin G-51.

AMPCO® AMPCO METAL, INC.

Dept. 44-D • Milwaukee 1, Wisconsin

Huntington Park, Calif. • Garland (Dallas County), Texas

B-89

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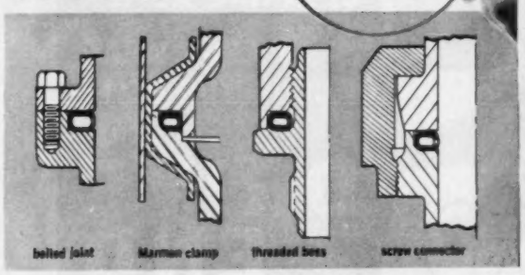
PRESSURE-TIGHT JOINTS 10⁻⁶ mm Hg-100,000 psi



United Self-Energized Metallic O-Rings*...

form positive, permanent, non-corrosive, static seals under pressure extremes from 10^{-6} mm Hg to 100,000 psi (or the ultimate compression stress of the metal itself) and temperatures from −452° to 3000° F. Available in various metals and coatings (including Teflon** and silver) ¼" O.D. to any size and configuration. United also makes non-vented and pressure-filled O-rings.

United Metallic "O" Rings, manufactured by United Aircraft Products, Inc., Box 1035, Dayton, Ohio.

See United Metallic O-Ring Catalog in Sweet's Product Design File or write for Free Handbook

Patents 2,809,295; 2,837,360

*DuPont registered trademark

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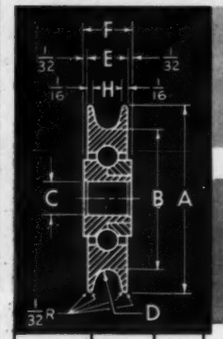
NOW! Standard Series of Ball Bearing Pulleys

For Rope, Wire Rope, Cable and Round Track Application



DELIVERY FROM STOCK

- Case-hardened steel
- Precision steel balls
- Unground raceways
- Cadmium plated
- Tapered groove

Pulley No.	A +.000 −.010	B	C +.004 −.000	D Rad.	Max. Cable Dia.	E +.003 −.003	F	Radial Cap. @ 100 rpm lbs.
SBP-14	⅛	⅝	3/16	1/16	⅛	5/16	3/8	15
SBP-16	1	¾	3/16	1/16	⅛	5/16	3/8	30
SBP-20	1¼	⅞	¼	3/32	3/16	3/8	7/16	50
SBP-22	1⅜	1	¼	3/32	3/16	⅜	7/16	50
SBP-28	1¾	1¼	⅜	⅛	¼	7/16	½	80
SBP-32	2	1½	⅜	⅛	¼	7/16	½	120

H—Maximum cable dia. plus 1/32"

SYRACUSE BEARING CO.

428 E. Jefferson St., Syracuse, N. Y.

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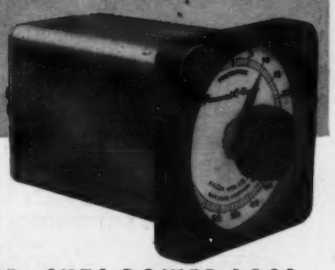
new HAGEN timer permits setting "on" time directly as PERCENT OF CYCLE



SAVES SPACE, CUTS POWER LOSS

Only 3-1/2" square at the face, 4-5/16" deep, the Hagen Percent-O-Cycle Timer is a worthwhile substitute for power-wasting rheostats and variable voltage equipment on many applications. Snap action contacts, operated by synchronous motor drive, permit this unit to handle loads up to 25 amps at 120/230 volts, 60 cycles.

REPEAT ACCURACY 1/10 OF 1%

Easy to read dial makes it possible to set timer to 1/4% of desired setting.

Send for new HAGEN Bulletin 1360.

Address Dept. DN-461

HAGEN BLISS MANUFACTURING DIVISION / BARABOO, WISCONSIN

Of The Gamewell Company

AN E. W. BLISS COMPANY SUBSIDIARY

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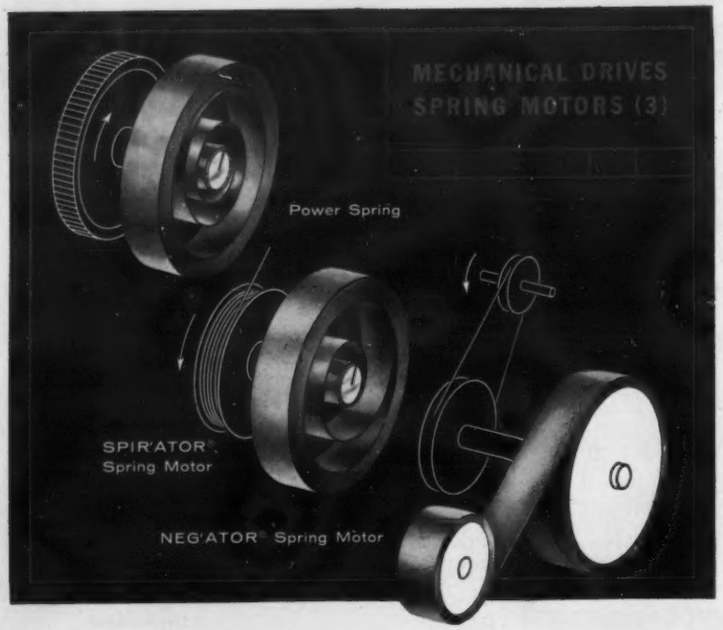
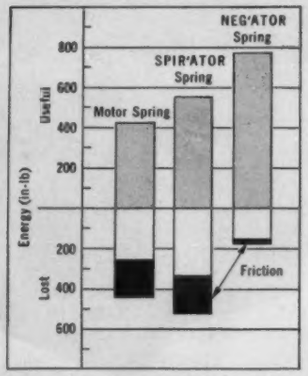


Drive it with

HUNTER SPRING POWER

Energy comparison of three Hunter motor springs having same weight of material



For a detailed comparison of these three drive units, write for a copy of "Motor Springs" to the address below.

HUNTER POWER SPRINGS

These familiar springs are better than ever before. Using materials and techniques discovered in manufacturing constant-force springs, Hunter has bettered the performance of, and added life to, conventional power springs.

HUNTER SPIR'ATOR® MOTORS

These prestressed spiral springs by Hunter are related to the power spring and the NEG'ATOR spring. They *look* like power springs—are *made* like NEG'ATOR springs. SPIR'ATOR motors produce as much as twice the length of running cycle in the same size package as a power spring.

HUNTER NEG'ATOR® MOTORS

These unusually long-running motors release the maximum useful energy and provide constant torque output. In NEG'ATOR motors, design engineers have a unique mechanical drive unit that provides many more turns than any other, is compact, very powerful and will not jump or skip.

HUNTER

HUNTER SPRING COMPANY

A Division of American Machine and Metals, Inc.

10 Spring Avenue, Lansdale, Pennsylvania

SPRINGS • STAMPINGS • QUALITY CONTROL EQUIPMENT

DIVISIONS OF AMERICAN MACHINE AND METALS, INC.: Troy Laundry Machinery • Riehle Testing Machines • De Bothezat Fans • Tolhurst Centrifugals • Filtration Engineers • Filtration Fabrics • Niagara Filters • United States Gauge • Rahm Instruments • Lamb Electric Co. • Hunter Spring Co. • Glaser-Steers Corp.

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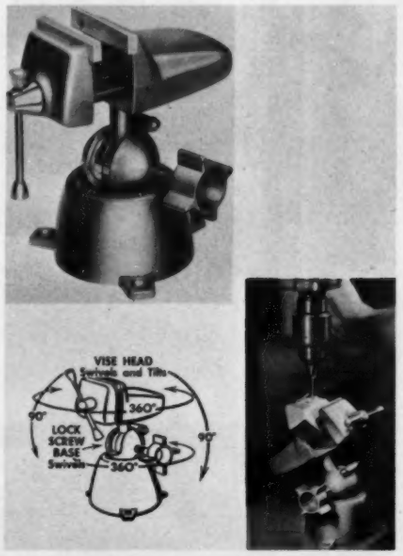
EQUIPMENT

Multi-Position Work Holder 376



A low-cost, time-saving device accepts work quickly and allows it to be positioned accurately, even to use with machine tools, such as drilling to close tolerances. Tool proper consists of two parts: a vise head (removable) which has a ⅝-inch dia post that fits into the positioning base and is held securely between two pressure discs (recessed to receive post). The vise head (or fixture) can be rotated 360 deg on any tangent to a half sphere to achieve any compound angle, or tilted a full 180 deg front and back. In addition, locking mechanism may be rotated 360 deg around base. "PanaVise", when properly tightened, will support 50 lb at 45 deg, 6 inches from axis of locking knob. The device is furnished with replaceable jaws, nylon or cold-rolled steel as specified. The jaws open to 2½ inches. Overall size of vise is 6½ by 5½ by 5½ inches. Weight is only 3½ lb.

Colbert Die Cast Co., Inc., 10107 Adella Ave., South Gate, Calif.

. . . And Full Information on How to Solve Difficult Drive Pulley Problems

VAN gorp MFG., INC. Dept. DN Pella, Iowa

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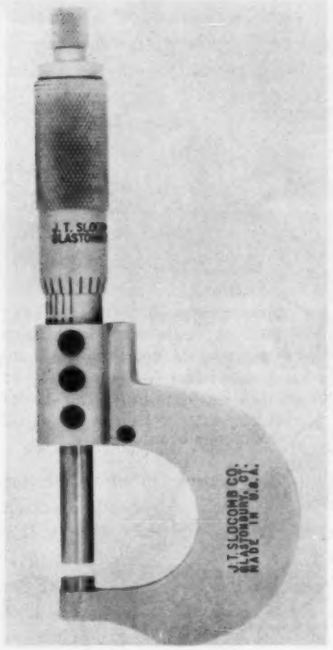
Direct-Reading Micrometer 377

Furnished with a fully finished satin chrome frame, this unit is complete with vernier for reading to tenths (0.0000) and is shipped in a clear plastic case with polyurethane liner for protection. Other features include protective windows which magnify digits, tapered frame, lapped anvil and spindle faces, special adjusting nut which maintains correct setting at all times, 17 percent larger spindle



and anvil area and elimination of spindle end play. "Speedmike" also is said to be precision balanced and unusually durable. Optional features available are friction stop, spherical ends, carbide-tipped anvil and spindle, 60-deg points, rounded anvil and ½-inch-dia discs.

J. T. Slocomb Co., South Glastonbury, Conn.

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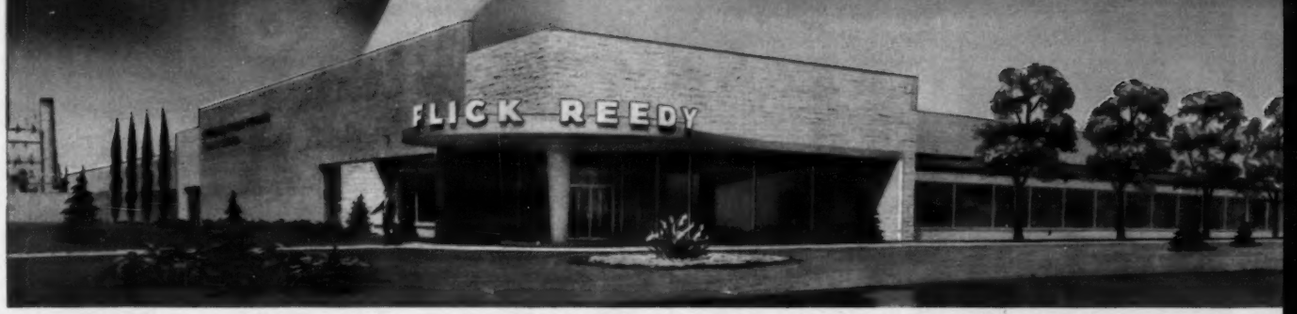
OPENING NEW HORIZONS

. . . in economical power application

98% PLUS OPERATING EFFICIENCY
MORE POWER PER CYLINDER DOLLAR
PROVEN LEAKPROOF OPERATION
GREATEST SELECTION EVER OFFERED
SAFE UNDER SEVERE LOADS
SAFE WITH ALL KNOWN HYDRAULIC FLUIDS
SAFE UNDER TEMPERATURE EXTREMES
DAMAGE-PROOF PISTON RODS

Miller HYDRAULIC CYLINDERS



Flick-Reedy . . . *Winner of "Plant of the Year" Award and "Silver Anvil" Public Relations Award*

MORE SAVINGS!

Our ultra-modern, new "Plant of the Year" with its special facilities and operating economies enable us to offer an **extra 10% price savings** on our big "stock" selection of:
Model "H" (Hyd.) Cylinders, 1½" through 8" bores;
Model "J" (Hyd.) Cylinders, 1½" through 14" bores;
Model "A" (Air) Cylinders, 1½" through 14" bores.
Strokes up to 36", cushioned and non-cushioned.

Full Details On Request

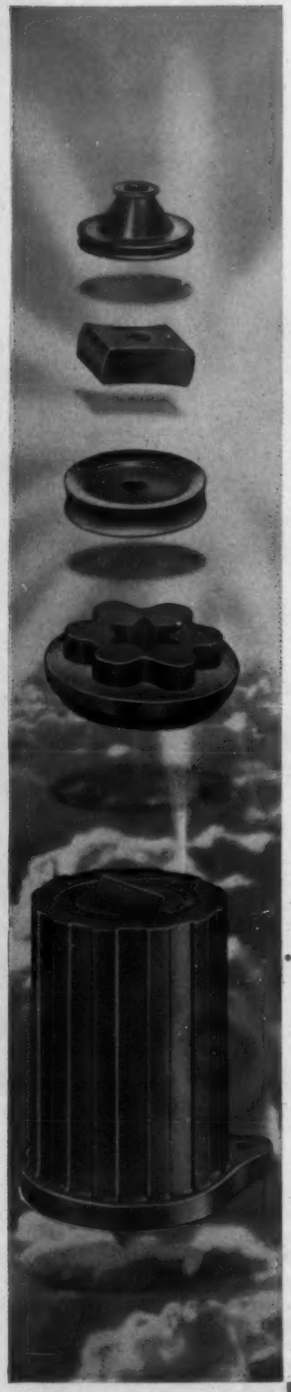
Miller Hydraulic Cylinders make impossible applications look easy. With Teflon Seals, Case-Hardened Rods (50-54 Rockwell C), Patented "Shef" Tubing End Seals, and other exclusive *standard* features, these cylinders are practically damage-proof, are ultra-dependable under pressure and temperature extremes, and provide leakproof sealing with ALL hydraulic fluids. Built to *exceed* J. I. C. Specifications, these cylinders are achieving new highs in production and operating economies in thousands of plants. Two great lines: Power-Packed Model H for 3000-5000 psi and Job-Rated Model J for 500-2500 psi. All bores, strokes and mounting styles. Big "Stock" selection for immediate shipment at substantial savings.

Write for literature.

R

MILLER FLUID POWER
DIVISION OF FLICK-REEDY CORPORATION
7N020 York Road, Bensenville, Illinois.

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS



when faced with CRITICAL SPECS get the GOSHEN RUBBER IDEA*

* to precisely fabricate parts, seals and components from selected compounds and for specific applications ONLY!

The tougher the specs, the more important it becomes that you have it "custom made by Goshen Rubber." If the part, or component you need can perform best by being fabricated from a natural, synthetic or silicone rubber compound, count on Goshen. Exclusive fabricating techniques, developed here at GRC, are available to meet strictest specifications, and for advance testing under many types of near-field conditions. Let us know your problem.

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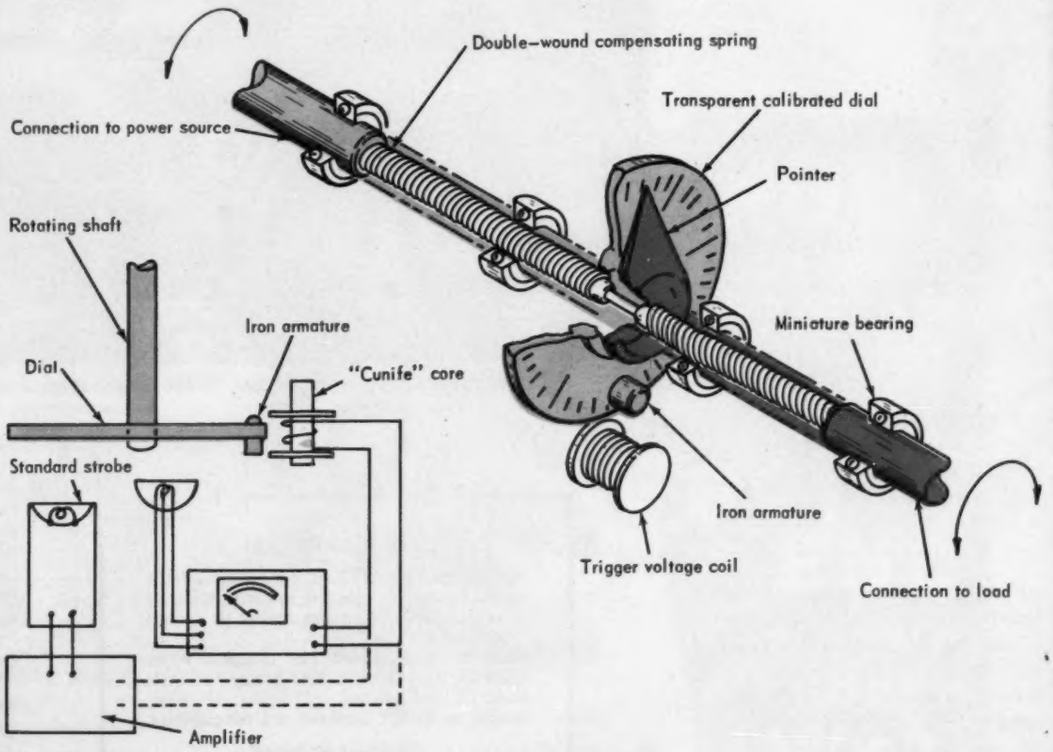
Acrylic Housing Permits Direct Measurement

Lars G. Soderholm, Midwest Editor

A sensitive torquemeter uses a housing and rotating dial of clear acrylic resin to permit direct measurement by strobe light of rotating torques over 100 rpm. An iron armature located on the rotating dial excites a stationary voltage coil which provides pulses to trigger a strobe, following speed changes of the dial. A counterwound spring element provides compensation for changes in spring length that occur as torque is applied.

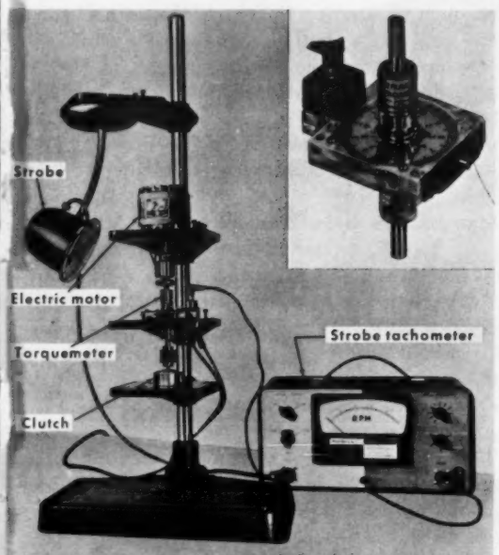
This instrument, designed to mechanically measure both static and rotating torques, uses two hollow shafts interconnected by a counterwound compensating spring element. One shaft holds a calibrated dial while the other holds the dial pointer. Under no-load conditions the dial and pointer will follow each other around as the shafts are rotated. Under load there is a lag between the pointer and the dial proportional to the rotating torque. This torque can be read directly through the clear plastic housing on the calibrated dial.

To get a numerical reading from the rapidly rotating dial, a strobe light is required. If a variable load is being applied to the power source, constant adjustment of the strobe would be necessary. To



TORQUEMETER OPERATION requires power source to be connected to shaft holding transparent rotating dial while load is attached to shaft holding pointer. Torque applied tends to unwind one section of the helical spring and to tighten other section of helical spring. This compensates for change of length in each section and maintains uniform preload on ball bearings.

of Rotating Torque



TYPICAL TEST measuring torque versus speed characteristics uses test stand to hold components. Electric motor drives through torquemeter to hysteresis-type clutch. Torque readings are taken under various load conditions. RPM is taken from tachometer on the combination strobe-tachometer.

overcome this difficulty, an iron armature is located on the dial so it will rotate past a ⅛-inch dia "Cunife" core, magnetized at 12,500 amp turns and having soft iron ends. Each rotation of the dial generates a small voltage impulse that is used to trigger the strobe. This rotation results in a pulse of about 0.001v at 100 rpm and 0.030v at 10,000 rpm. A finger collet is provided for use in measuring static torques. Readings can be taken from either side in either direction as seen through the transparent enclosure. Accuracy of the instrument is within 3 percent for slow-moving torques and 5 percent on rotating torques. Three models provide torque ranges of 0.5 to 10 gram-centimeters, 1.2 to 25 gram-centimeters and 5 to 100 gram-centimeters. Total overall weight is 85 g (3 oz).

The 782 Gram-Torqmeter has been developed by Power Instruments, Inc., Skokie, Ill.

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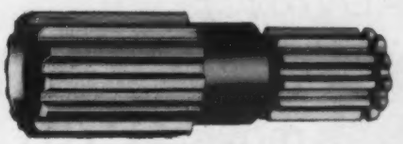
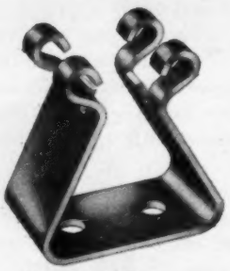
WRITE SPECS
YOU'VE NEVER
WRITTEN BEFORE!


Good Corrosion Resistance

Non-Magnetic

Good Conductivity


Wide Operating Temperature Range

High Spring Retention

Excellent Wear Resistance and Hardness

BERYLCO Beryllium Copper alloys combine all these properties By extending the performance possibilities of metal parts, Berylco beryllium copper alloys are opening new areas of design thinking. And you can specify Berylco alloys without fear of complication because they fabricate easily by standard production methods. Some designers are finding that *one* beryllium copper part will do where two parts were formerly required. Factual data on Berylco alloys will show you why the use of strip, rod and casting ingot is increasing so rapidly. Write now for our latest BERYLCO BERYLLIUM COPPER BULLETIN. A knowledgable, experienced technical staff of field men and mill men stand ready to help you develop design possibilities into performance realities.

High Strength

Resistance to Anelastic Behavior

High Fatigue Strength

BERYLCO
THE BERYLLIUM CORPORATION
Reading, Pennsylvania
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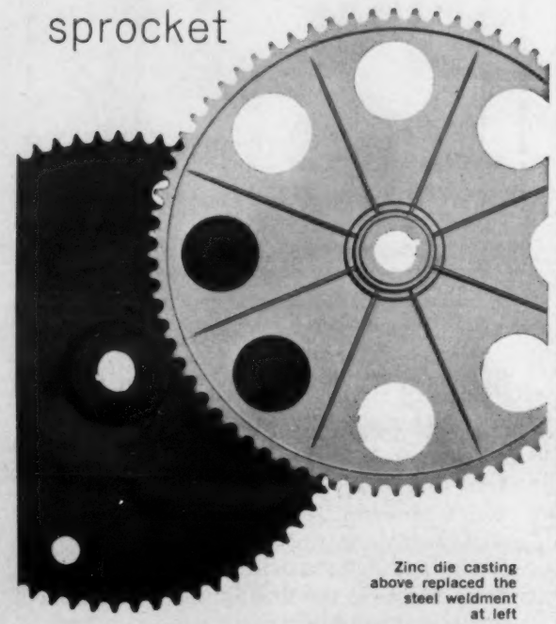
ADVANCE put
teeth *
into reducing
the cost of this
sprocket



Zinc die casting above replaced the steel weldment at left

*
By "teeth" we mean Advance engineers bit deep into the cost of the 12-inch steel weldment sprocket shown above and came up with a **saving of better than 50%** in converting it to a zinc alloy die casting.

The sprocket drives the rotating drum of an industrial clothes dryer. Both pitch and O.D. are held to .010 tolerance. Interchangeable cores and inserts readily produce this sprocket with ¾ or 1 inch bore.

Whether it's a conversion, or a die casting of completely new design, putting "teeth" into a die casting cost problem is what Advance engineers like most to do.

Why not send your next print to Advance for a quotation? Ask for the Advance folder "Your Doorway to Certified Zinc and Aluminum Die Castings".

These symbols are your assurance of highest quality control of zinc and aluminum alloys under ADCI standards.

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High-Temperature Metals without Strategic

Robert L. Candlish, Detroit Editor

A recent development of new high-temperature alloys fulfills a major design requirement for high-production automotive gas turbines. The requirement was for materials that are readily available, nonstrategic, inexpensive, corrosion-resistant and possess the necessary strength at the operating temperatures.

The hot strength, stress, rupture and creep characteristics of Cobalt alloys commonly used in gas turbines are necessary. Also, the material must be subject to fabrication and joining in a quick, easy and inexpensive fashion. Cobalt could not be used as it is defense-critical, is expensive and the known free-world supply could not support automotive volumes.

Two new materials have been developed. One has a stress to rupture value of 30,000 psi at 1500F for 100 hr.

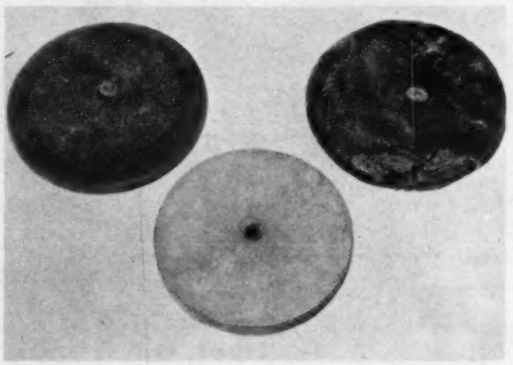
The second has a value of 27,000 psi under the same conditions. The higher strength material is suitable for turbine blades, the other may be used for nozzles and similar parts.

An oxidation-resistant material also has been developed that has no strategic or critical alloy content. The strength is modest and it is useful for parts such as burner liners and for other parts where outstanding hot strength is not a particular requirement.

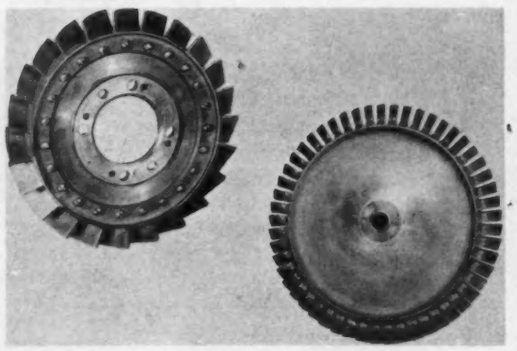
A material was developed to operate without lubricant over a wide temperature range for the gas seals on the regenerative heat exchanger. This has shown no appreciable depreciation after 1000 hr of testing.

Materials are under development that will make possible a 400F increase in nozzle inlet temperature. This can effect a 40 percent increase in specific output of a given size of power plant and at the same time decrease fuel consumption more than 20 percent without any increase in component efficiency. Problems associated with higher temperatures now are considered no more difficult than problems already solved appeared to be five years ago.

The noncritical alloys for gas turbine work have been developed by The Engineering Research Section of Chrysler Corp.'s Engineering Div.

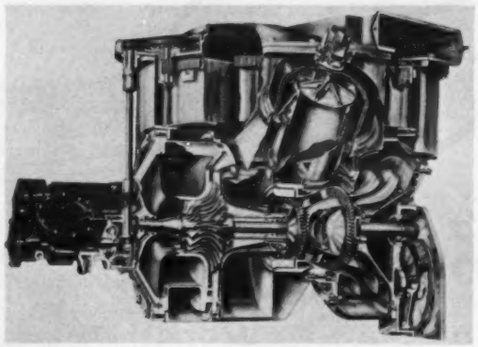


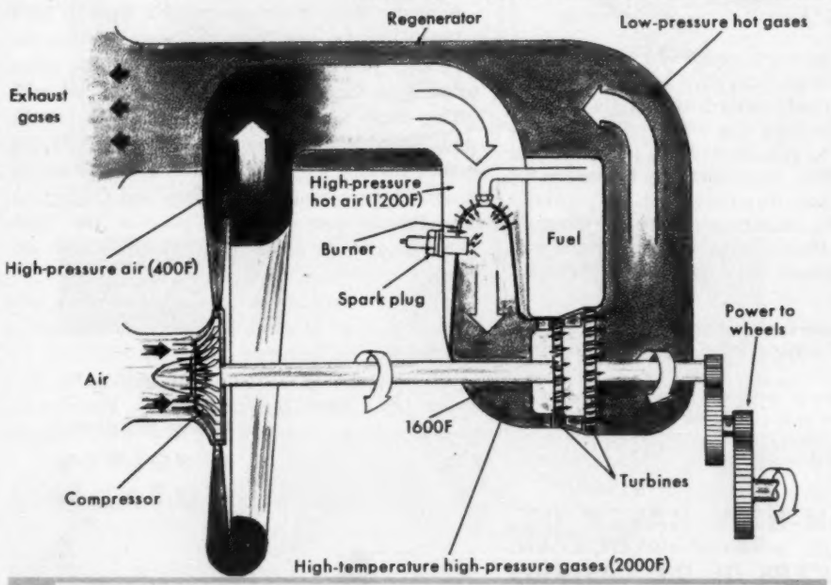
HIGH-TEMPERATURE STABILITY evaluation after soaking for 150 hr at 2300F in air. At left is 18-8 stainless steel, at right is aluminized plain carbon steel, in foreground is sample of Chrysler alloy.



FIRST-STAGE TURBINE WHEEL AND NOZZLES. Blades, nozzles and supporting rims are precision-cast units. Wheel is weldment of blade and rim casting plus hub and disc of lower alloy. Fuel control limits wheel temperature to design value.

Alloys Advance Automotive Turbine





PROGRESS IN AUTOMOTIVE TURBINES

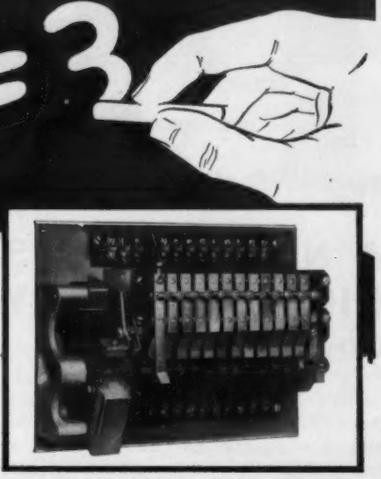
	1956 MODEL	1961 TARGET
Horsepower	225	140
Fuel consumption (lb/bhp/hr)	0.54	0.49
Maximum cycle temperature	1600 F	1600 F
Air flow (lb/sec)	3.1	2.0
Pressure ratio		4.3
Gas generator lag* (seconds)	6.0	1.5*

*Because of high torque of turbine, vehicle starts to move considerably before generator builds up to maximum output.

FIRST TURBINE STAGE drives gas generator compressor. Second turbine is free and supplies power for vehicle. Rotary regenerator gear driven from compressor section turns at approximately 18 rpm at cruise. Regenerator is divided with 1/3 of it heating air to burner. Regenerator efficiency is more than 90 percent and high-pressure leakage is limited to 4 percent. Drive reduction into car automatic transmission is 9 to 1.

A BASIC CONTROL IDEA

as simple as 1+2=3



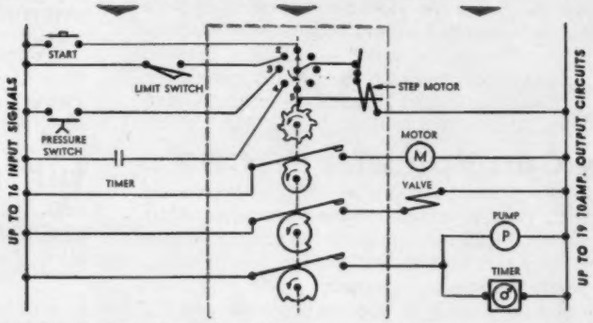
DESIGN YOUR NEXT MACHINE OR PROCESS CONTROL CIRCUIT THIS EASY WAY

Start with THE BULLETIN 780 STEP SWITCH FOR STEP-BY-STEP SEQUENCE CONTROL

1. INPUT SIGNALS
Closure of a control device, actuated upon completion of an operation, advances control to next position.

2. BULLETIN 780 STEP SWITCH
Circuits are opened or closed at each position or step according to preselected cam action.

3. PROGRAMMED SEQUENCE CONTROL
Loads are interlocked thru step switch cams without complicated relay circuitry.



Write for Bulletin 780 or call your local Representative. He's listed in Sweet's Product Design File, Section 7d/EA, or in Thomas Register.

Precision Interval Timers | Plug-in Reset Timers | Multiple Circuit Timers | Multiple Cam Timers | Predetermined Counters | Hermetically Sealed Timers

MANUFACTURERS OF THE MOST COMPLETE LINE OF INDUSTRIAL TIME-COUNT CONTROLS AVAILABLE

EAGLE SIGNAL COMPANY • Moline, Illinois
INDUSTRIAL DIVISION

DIVISION OF THE GAMEWELL COMPANY, AN E. W. BLISS COMPANY SUBSIDIARY

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NOW AVAILABLE TO DESIGNERS AND PRODUCT PLANNERS

*PDCS

*PROTOTYPE DIE CASTING SERVICE

A NEW PROCESS WHICH PROVIDES PROTOTYPE DIE CASTINGS WITHOUT HIGH COST TOOLING

What is PDCS?

Prototype Die Casting Service is a refinement and perfection of a plaster mold casting process which has been developed over a period of a year and a half of intensive research and test to a point which allows the low cost creation of simulated die castings, in small quantities, without the cost of conventional, permanent tooling. A Prototype Die Casting looks, feels, finishes and performs remarkably similar to a production die casting.

Why Was PDCS Developed?

The growing demands of designers, product planners, purchasing officials and sales management personnel prompted Newton-New Haven Company's development of the process. While the individual needs of all were different, the basic need behind them all was identical . . . a production method which would allow them to secure . . . each for their own reasons . . . small, low cost quantities of simulated die castings without underwriting permanent tooling charges.

How Can You Use PDCS?

If part of the product you are planning is to be a die casting and your customer requests samples before placing orders, PDCS can represent the solution to your problem. Or, if you wish to test the function of an assembly which includes a die casting . . . determine the strength of a die casting as applied to your needs . . . gauge the sales appeal of your product by sampling . . . judge the "feel" and appearance of a die casting . . . PDCS provides the means. If you are interested in holding down the cost of new product development and avoiding expensive design errors it will pay you to fill out the coupon in this announcement and mail it today as a first step in learning more about PDCS.

How Much Does PDCS Cost?

Very little compared to the advantages and cost savings PDCS can achieve for you. The factors determining cost are shape and complexity of the part as well as the quantity required.

How Can You Start To Work With PDCS?

If you have a part in design to which you believe PDCS may provide an answer and you have prints of the part to be Prototype Die Cast, forward the prints with an indication of the quantities you will require. A cost-estimate will be sent to you. Should you have a model of the part, but no prints, the model may be sent in for cost-estimating purposes. If you have just an idea about the part and not prints, sketches or models, a Newton-New Haven Technical Representative will call on you and assist in the development of drawings sufficient for cost-estimation.

From your prints, models, sketches or ideas, if part of your product is to be a die casting . . . start with PDCS

* *This name identifies an exclusive service of the Newton-New Haven Company, developed to serve the needs of Designers, Product Planners and others in industry interested in die castings as the quality method of mass production.*

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I have a problem to which PDCS may be the solution. Without cost or obligation to me or my company . . .
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'Teflon' O-Ring

Edward W. Schrader, Western Editor

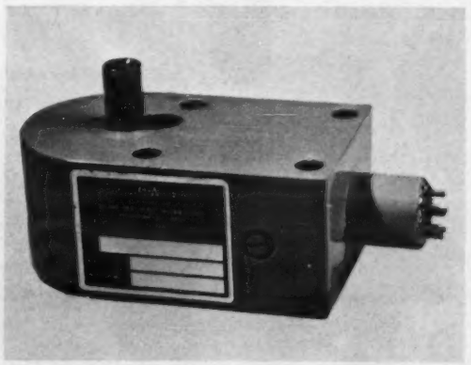
"TEFLON" O-RING acts as face seal under compression spring forces. Silicone rubber O-ring makes radial seal with stationary body and O-ring collar. "Teflon" ring seats in concave annulus on end of O-ring collar.

A "Teflon" O-ring acts as a face-type seal in a sequencing switch. A silicone O-ring serves as a static radial seal. Thus, the rotating input shaft to the switch approaches a class A hermetic seal.

Two compression springs, mounted on either side of the shaft shoulder, apply an eight-lb force to the O-ring collar. The axial force pushes the "Teflon" O-ring against the rotating collar screwed to the shaft. The opposite end of each spring bears against a "Teflon" washer on the shaft shoulder. Squeeze of the silicone O-ring makes this ring serve as static seal and prevents rotation of the compression springs and O-ring collar. Low-friction "Teflon" permits the shaft shoulder and the shaft collar to rotate with the shaft.

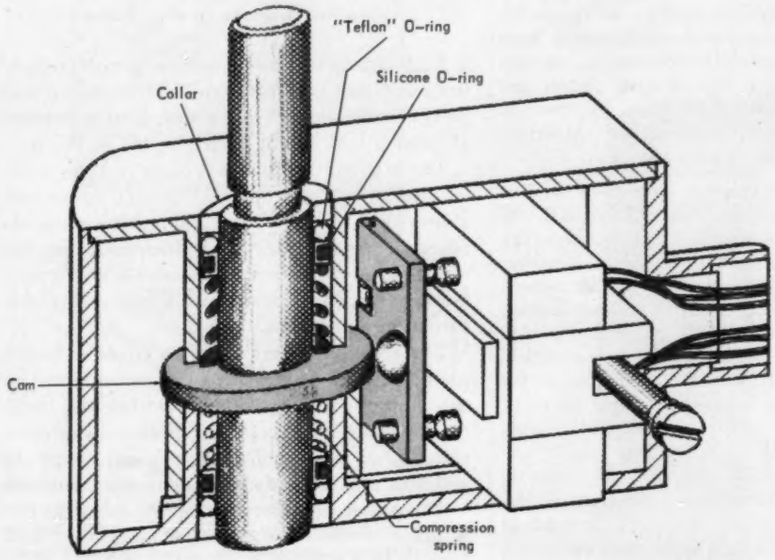
The shaft shoulder is also a cam with a lobe to trip a pair of electrical switches through a simple pivoted linkage.

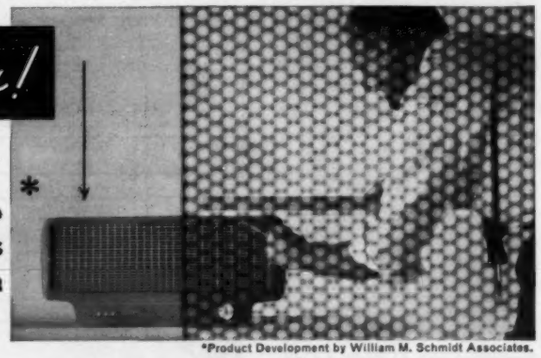
The sequencing switch is produced by The Divac Div., Acme Machine Works, Hawthorne, Calif., under exclusive license from the Northrop Corp.



SEQUENCING SWITCH transmits electrical signal from rotary motion. Shaft has male serrated shaft on one end and female section on opposite end. This permits ganging for multiple sequencing. Switch meets applicable MIL specs and is used as landing-gear switch on aircraft.

Acts as Face Seal in Sequencing Switch



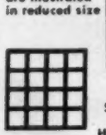


Idea!

mock-up projects design

*Product Development by William M. Schmidt Associates.

A few of the thousands of H & K patterns are illustrated in reduced size



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Here is an H & K perforated metal grille utilized in a mock-up of a record player. This greatly helps the Industrial Designer project his concepts as H & K perforated metal is now in its proper element for consideration of use and selection of pattern.

By referring to the H & K General Catalog, the designer can select one or more patterns for his project.

H & K perforated metals provide the Industrial Designer, and other men of ideas, a medium of unlimited opportunities for designing better and more attractive products.

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ELECTRONIC SEAM WELDING

fastens with parent-metal strength.

Here's the newest technique in electronic welding – automatic spot or seam welding from the same power supply! Weldmatic's new Model SA-3010 Varimatic Seam Weld Control connects to 115 volts a.c. and any Weldmatic power supply to give you these six advantages:

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30 to 180 welds per minute at a continuous adjustable rate

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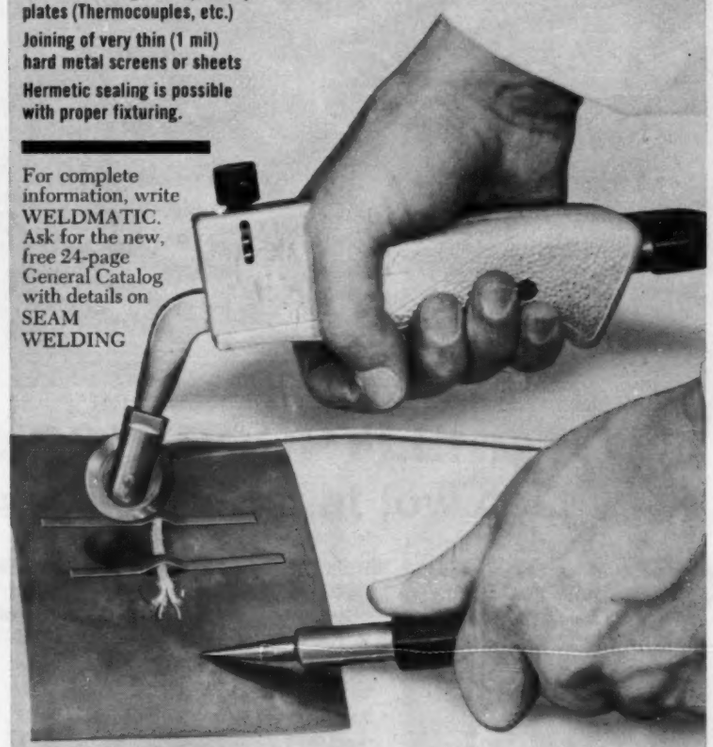

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OIL SEALS
in Design
Engineering

Garlock KLOZURE* Oil Seals stop oil leakage at bearings, increase efficiency of Denison Variable-Volume Hydraulic Pumps.

Denison designs hydraulic pumps around Garlock KLOZURE Oil Seals to assure maximum sealing efficiency.

Where pressures are too high for ordinary lip seals, KLOZURE Oil Seals prevent leakage of hydraulic oil and protect vital bearings as temperatures reach 150°F, pressures rise to 35 p.s.i., and shafts whirl at 1800 r.p.m. In use for the last twelve years, the seals have given complete satisfaction on the well-known line of axial piston and vane-type pumps made by Denison Engineering Division of American Brake Shoe Company.

Wherever bearings must have the best protection, Garlock KLOZURE Oil Seals are specified. On pumps like Denison . . . in steel mills . . . on power shovels and lift trucks . . . for motors, KLOZURE Oil Seals prevent leakage of lubrication, seal out harmful foreign matter. Whatever the application, there is KLOZURE Oil Seal to do the job. They are oil and grease resistant, impervious to mild acids and alkalies, non-abrasive, and will withstand temperatures from −40°F to +250°F. For extreme conditions, Garlock furnishes sealing elements resistant to practically any fluid, and serviceable as high as +500°F.

Availability is another prime reason for selecting Garlock KLOZURE Oil Seals. Once your design is finalized, you may select the proper seal from over 1800 stock items available from 180 national bearing distributors, including one near you.

It makes good sense to design with KLOZURE Oil Seals, as Denison and hundreds of other leading companies have found. See how you can benefit—call in your local Garlock representative. You will find him at the nearest of the 26 Garlock sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalog AD-181. Garlock Inc., Palmyra, N. Y.

GARLOCK

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Plastics Div.: United States Gasket Company.

Order from the Garlock 2,000 . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastics Products.

*Registered Trademark

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Four-Element Drip Pan

Victor W. Wigotsky, Eastern Editor

A high-impact styrene extrusion greatly simplifies a drip pan assembly. The number of required parts is reduced from 22 to four. Cost is reduced 45 percent and weight from 47 to 17 oz per ft.

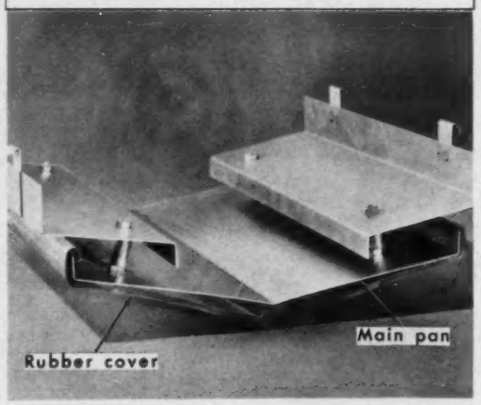
The original drip pan was made of three stainless-steel panels and included spacers, screws and a heavy rubber extrusion. The rubber part was necessary to insulate the condensation on the metal pan. Insulation requirement is eliminated, however, with the high-impact styrene, since condensation will not form on it.

The redesigned unit utilizes a single extruded plastic profile. This is then cut and oriented in two positions with a simple fabricated wire hanger. Assembly requirement is practically non-existent, when compared to the original design. In addition, efficiency of air circulation is improved.

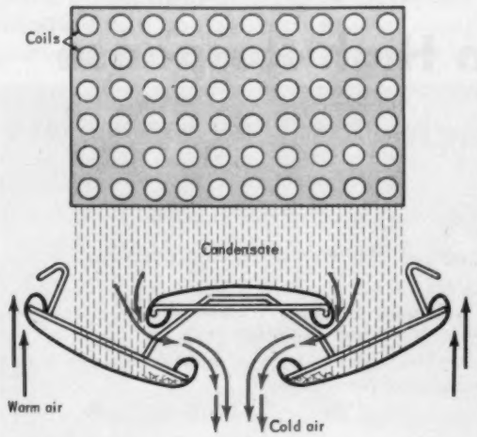
The plastic extrusion used in the new drip pan is manufactured by Anchor Plastics Co., Inc., Long Island City, N.Y., for Frigid Igloo Mfg. Corp., Yonkers, N. Y.

PARTS LIST FOR ORIGINAL PAN

ITEM NUMBER	DESIGNATION	MATERIAL	NO. PARTS REQUIRED
4	Flash pan cover	Extruded rubber	1
3	Main pan	22-gage stainless steel	1
2	Extension pan	"	2
5	Hanger	"	2
7	Spacer	Copper tubing	2
9	Bolt	Brass	2
Not shown separately	Lock washer	Steel	4
"	Sealing washer	Plastic	4
8	Nut	Brass	4
		TOTAL	22

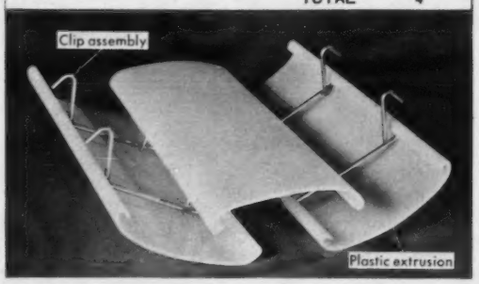


Eliminates 18 Parts



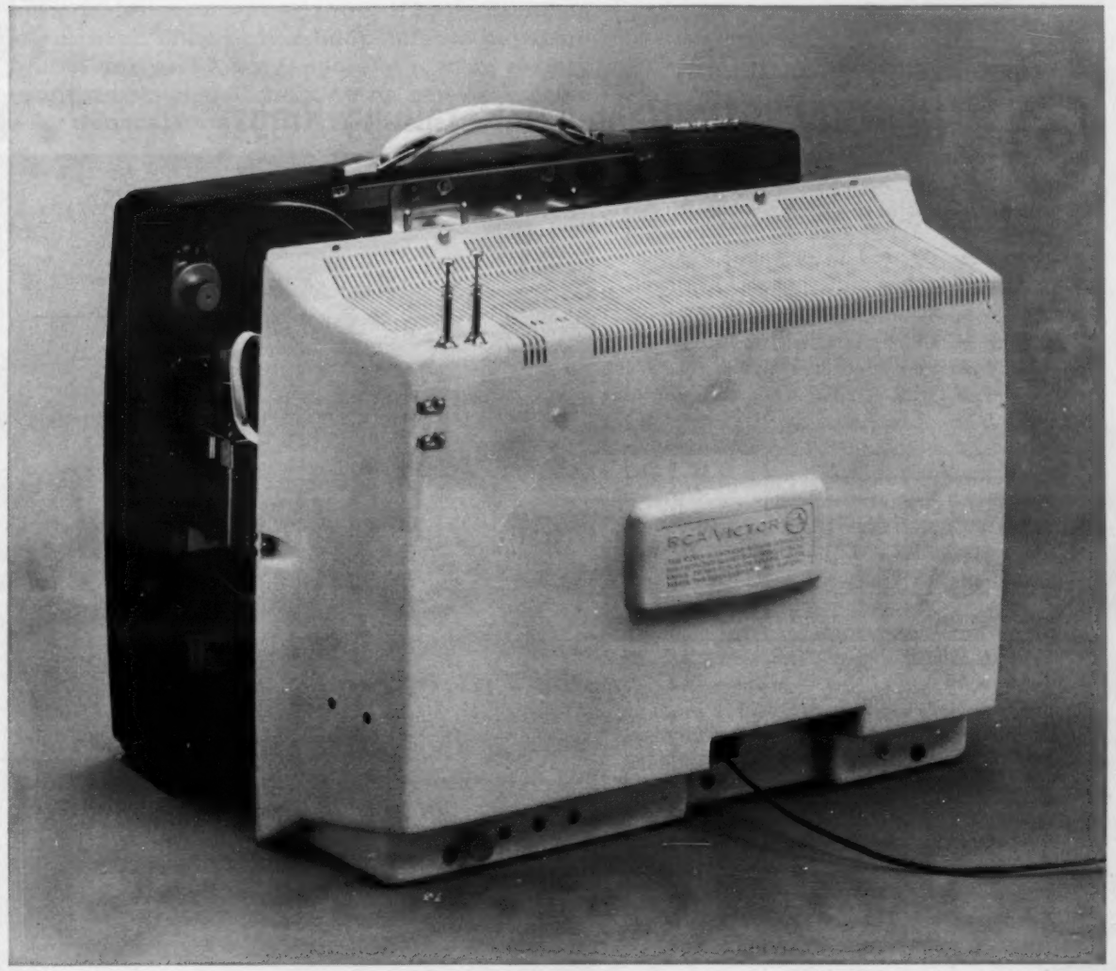
AIR IS COOLED BY GRAVITY COILS at top of cabinet and flows downward over merchandise. If a solid drip pan were used, a large portion of air flow would be blocked off and cooling efficiency impaired. Widely spaced three-part plastic unit, however, permits cool air to circulate, while condensate falls in straight line.

PARTS LIST FOR NEW PAN			
ITEM NUMBER	DESIGNATION	MATERIAL	NO. PARTS REQUIRED
1	Flash pan extrusion	High-impact styrene	3
2	Clip assembly	Aluminum wire	1
		TOTAL	4



NEW DESIGN requires only four parts as compared to 22 parts for an equivalent length. Original unit was fabricated from sheet-metal parts which were cut, formed and required accurately located holes. Also, hangers were cut, formed and welded, and spacers were made from copper tubing. Formed pans then were placed on jigs and assembled. Rubber extrusion was snapped over bottom pan to insulate condensate. New extruded plastic unit is assembled by simply taking long extruded section, cutting to desired length and slipping over required number of fabricated wire hangers.

WHAT'S NEWS IN PLASTICS



Escon® POLYPROPYLENE
resists heat distortion...at low cost

The backing for this new RCA television receiver is molded of Escon polypropylene in an attractive textured finish. RCA chose Escon because of its high heat deformation point and balance of other important properties. In addition, Escon polypropylene has excellent electrical properties and allows considerable design freedom.

Parts made with Escon polypropylene resist stains and are easy to clean. Colors can be matched easily. Cost of finished parts is lower than those made of any other thermoplastic material that can provide similar properties. For full performance data and complete technical assistance, write to Enjay at 15 West 51st Street, New York 19, New York.

EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

ENJAY CHEMICAL COMPANY

A DIVISION OF HUMBLE OIL & REFINING COMPANY

ENJAY PLASTICS

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DESIGN DATA NEWS

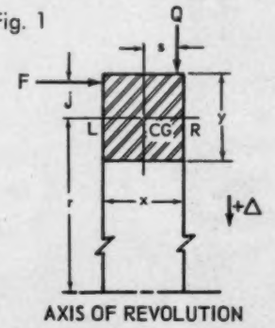
Deflections of Rectangular Retaining Rings

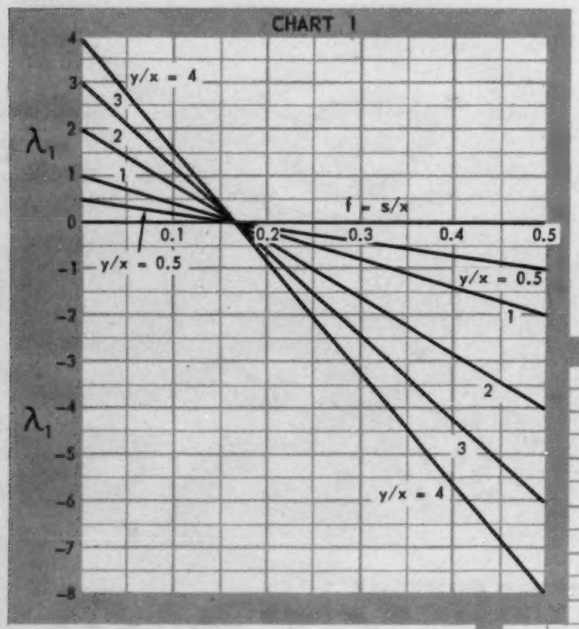
Robert I. Isakower, Rockaway, N. J.

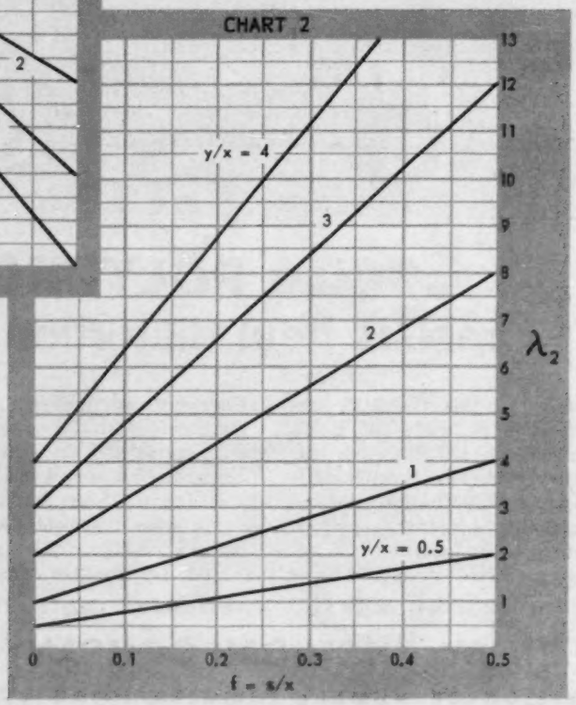
Retaining rings are used to provide a bearing surface or shoulder in a wide variety of mechanical assemblies, including such applications as positioning components on shafts, locking end caps on pressure vessels and nozzles, and locking or positioning concentric cylindrical shapes in telescoping mechanisms. The rings generally are assembled in annular grooves to provide maximum resistance to axial loading.

In the typical assembly, the ring displacements

Fig. 1







How To Assure THE MAXIMUM In High Response Clutch-Brake Systems

The clutch-brake unit you use must provide these basics:

1. minimum armature transfer distance between the brake and clutch housings.
2. clutch and brake friction surfaces held to a high degree of parallelism.
3. no backlash between armature and shaft.
4. clutch and brake friction facings burnished to give rated torque on installation.
5. closely held tolerances and finishes on all important surfaces.
6. minimum armature inertia without any sacrifice in mechanical strength.
7. magnetic circuit ability to respond to the field-forcing technique mentioned below.
8. positive armature release through absence of metal to metal contact and built in return action.

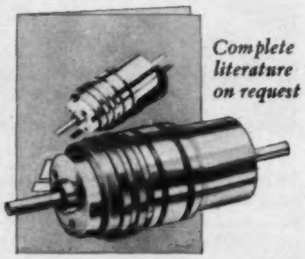
Because of the exclusive patented diaphragm, these features have been built into Simplatrol electric clutches and brakes.

The electric circuitry employed determines to a large extent the clutch reaction time. Reaction time is ordinarily reduced when a high momentary over-voltage is supplied (i.e., a voltage considerably in excess of the steady state rated voltage). Simplatrol can provide helpful suggestions on circuitry. Time required to bring load up to speed is a function of load inertia, r.p.m., and the torque of the clutch-brake.

Simplatrol's engineering organization will work with you to accomplish maximum speed, smoothness and quietness in your clutching and braking. Ask about applications of standard and custom designs in Simplatrol Electric Clutches and Brakes.

Investigate the total efficiency and economy of operation of the single complete unit, in torque ratings of 10 ounce inches to 470 pound feet, in sizes from 7/8" dia. to 12½" dia.

See for yourself the unique advantage of the flexible diaphragm action . . . the *only* moving part in a Simplatrol unit. Get the facts now on Simplatrol clutches and brakes.



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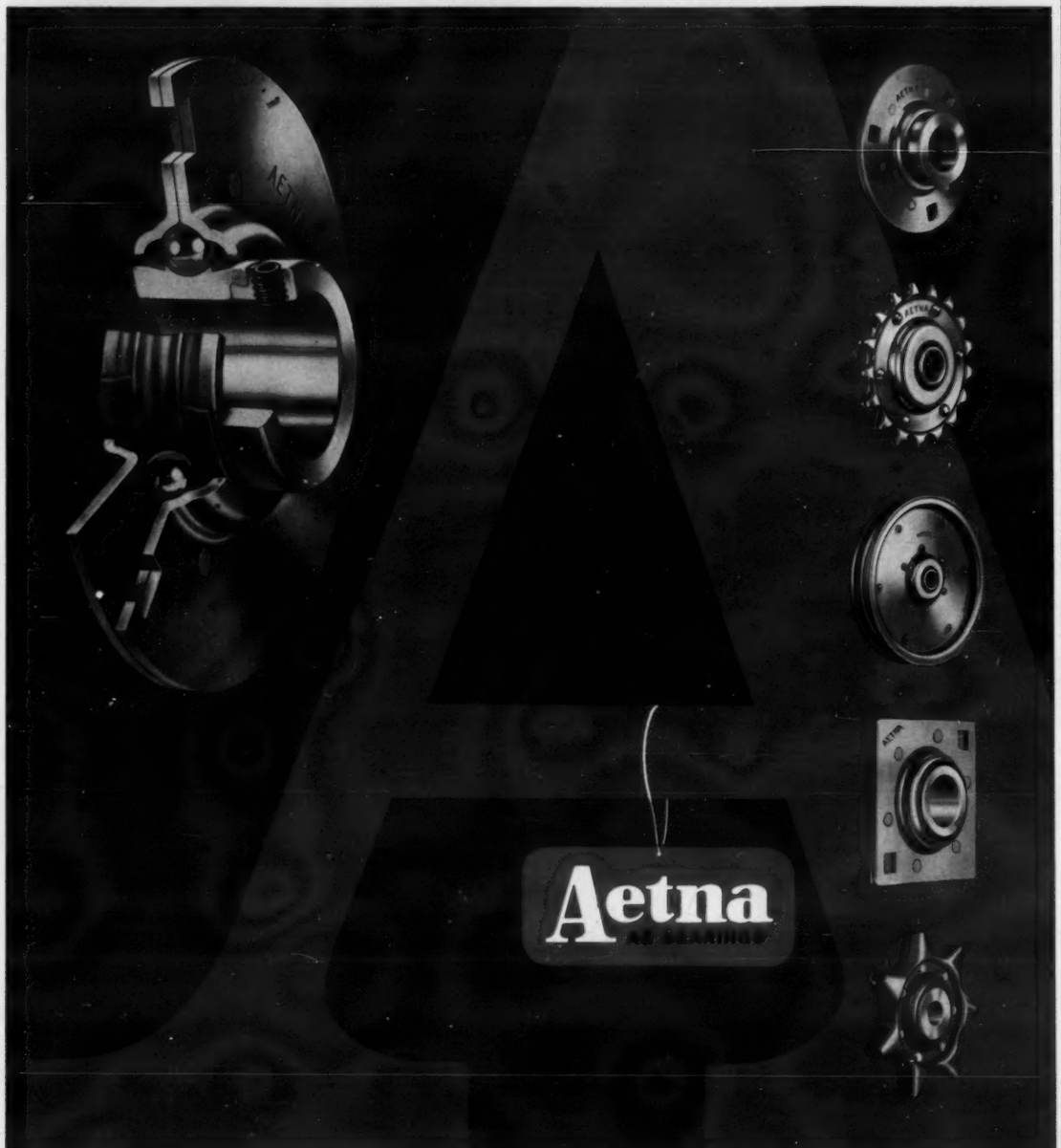

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ANTI-FRICTION SUPPLIERS TO LEADING ORIGINAL EQUIPMENT MANUFACTURERS SINCE 1916

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rather than stresses are usually the governing design criteria. (The ring may not engage the groove if ring deflection is excessive. The ring also may bind in the groove, resulting in a complex stress pattern as well as poor positioning of components.)

This article is intended as a quick aid in evaluation of displacements (and stresses) of retaining rings with rectangular cross-sections. The ring loads considered are uniformly distributed axial loads (F lb/inch of circumference) and uniformly distributed radial load (Q lb/inch of circumference). If the axial load F acts through the centroid of the ring's cross-section, it produces no effect. If it is applied with an eccentricity of j, it will cause the cross-section to rotate.

All points on the cross-section, with the exception of the centroid, will be displaced by an amount equal to the ring's rotation times the distance of that point from the centroid. If the radial load Q acts through the centroid, it will cause a radial displacement. If Q is applied with an eccentricity of s, it will cause the cross-section to rotate. This rotation also will cause a displacement of all points, except the centroid, by an amount equal to the rotation times the distance of that point from the centroid. The ring may be loaded by any number of F or Q loads, the effects being superimposed to yield the total displacement of any point on the ring.

The following assumptions are made:

(1) Ring material is homogeneous and isotropic. The elastic limit is not exceeded.
(2) Ratio of mean ring radius (r) to radial thickness (y) should not be less than 10 for greatest accuracy.
(3) Cross-section of the ring is rigid and does not deform during loading.
(4) Principle of superposition may be applied.
(5) All loads are "loads per unit inch of circumference".
(6) Ring cross-section is relatively compact; $\frac{1}{3} \leqq x/y \leqq 3$.
(7) The effect of shifting of position of the applied loads during loading is neglected.

Displacements:

Point L

$$\Delta_L = \frac{K^2}{E}(Q\lambda_1 - F\lambda_3) \qquad (1)$$

Point R

$$\Delta_R = \frac{K^2}{E}(Q\lambda_2 + F\lambda_3) \qquad (2)$$

Center of gravity of ring cross-section

$$\Delta_{cg} = \frac{K^2}{E} Q\left(\frac{y}{x}\right) \quad (3)$$

Stresses:

$$\sigma_{axial} = \frac{F}{y}\left(\frac{r+j}{r}\right) \quad (4)$$

$$\sigma_{hoop} = (\Delta_i/R_i)\, E \quad (5)$$

$$\sigma_{radial} = Q/x \quad (6)$$

Where:

$K = r/y$

E = modulus of elasticity

Δ_i = radial displacement of arbitrary point i

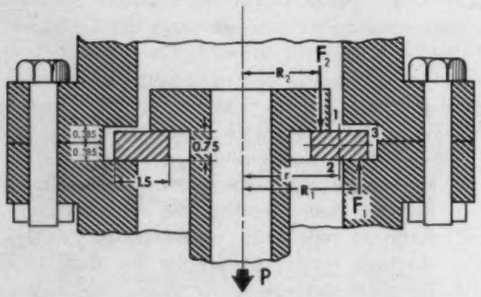
R_i = radius to arbitrary point i

$\lambda_1, \lambda_2, \lambda_3$ = "geometry factors", functions of ring cross-section and eccentricities. $\lambda_1, \lambda_2, \lambda_3$ are found in Charts 1, 2 and 3.

The eccentricities j and s are expressed in terms of f where $f = s/x$ and $f = j/y$ and where $0 \leqq f \leqq 0.5$.

Example:

A cylindrical vessel is "hung" inside a second cylindrical shell. The inner shell rests upon a retaining ring which is inserted in an internal



groove in the outer shell. Determine the deflection of the retaining ring to ascertain whether interference occurs between the ring and upper ledge of the groove. (If interference does occur, it will result in an imposed uniformly distributed axial moment on the outer shell which then must be considered during the analysis of the outer shell.) The load $P = 10{,}000$ lb and the ring is of steel, $E = 30\,(10^6)$ psi.

Solution:

$R_1 = 15.30$, $R_2 = 14.40$ and $r = 15.00$ inches.

$\therefore F_1 = P/2\pi R_1 = 104.02$ lb/inch

$2\pi R_2 F_2 = 2\pi R_1 F_1$

$\therefore F_2 = (R_1/R_2)\ F_1 = 110.52$ lb/in

ORANGE JOURNAL ROLLER BEARINGS

offer many design advantages!

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Narrow wall sections and multiple lengths are ideal

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--where shafts are close together
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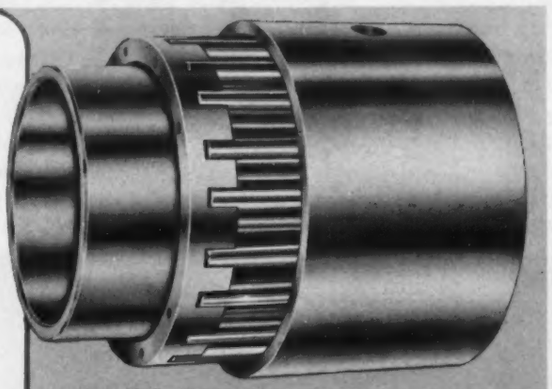
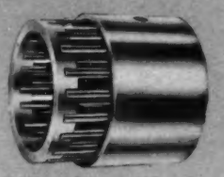
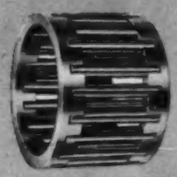
--where a wider journal is needed
--or other applications where a space-saving, high-load bearing is desirable



Type JRCS — Sleeve, Cage and Casing for use on unhardened shafts and housings.



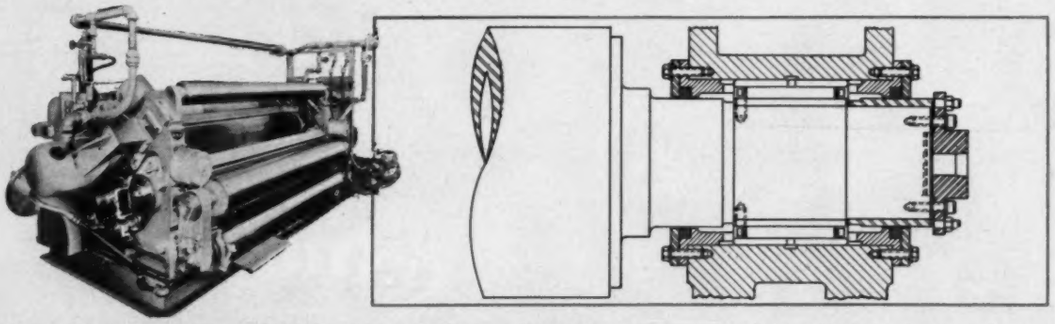
Type JRC—Cage and Casing for use on hardened and ground shafts.



Type JR—Cage Only. Low-cost, space-saving cage-and-roller assembly.

Orange Journal Roller Bearings are narrow-sectioned bearings that fill a place between needle bearings and cylindrical bearings, dimensionally and in load capacity. They are relatively economical, rugged, precision bearings made in three separable parts, usable three ways. Sleeve and casing are made of thru-hardened and centerless ground SAE 52100 steel; machined hard bronze cage retains precision rollers.

It is easy to meet your specific needs in load, bore and length from the many combinations available from stock, including 30 sizes from 5/8" to 5" bore, in nine lengths from 1" to 5", offering a choice of three to five lengths for each bore.



Drawing shows Orange Journal Roller Bearing in journal of pressure roll in type HKD single facer corrugating machine built by S&S Corrugated Paper Machinery Co., Inc., Brooklyn, N. Y. Bearings are installed at both ends of two corrugating rolls and one pressure roll. Made with precise clearance to allow for thermal expansion in heat reaching 350° F., the bearings ideally meet all load, space and operating requirements.

Write for Orange Reference Manual M-59, giving complete details and specifications of Orange Journal Roller Bearings, plus other Orange Roller Bearings.

ORANGE ROLLER BEARINGS

ORANGE ROLLER BEARING CO., Inc.
559 Main Street, Orange, N. J.

Needle Bearings — Staggered Roller Bearings
Journal Roller Bearings — Thrust Roller Bearings
Cam Followers

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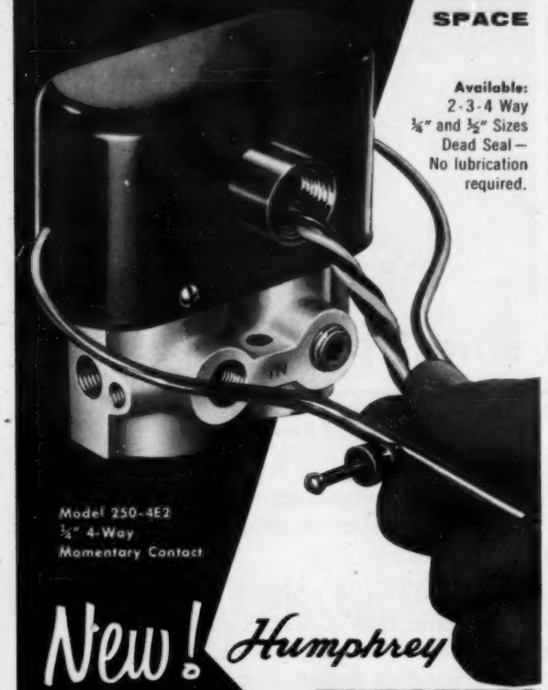
DESIGN BIG VALVE CAPACITY.....INTO SMALL SPACE



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Momentary Contact

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Shipping Weight—3 lb. 4 oz.
Dimensions—4-5/16" x 4-1/4" x 2-3/8"
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EXCLUSIVE ELECTROPACT DESIGN
Coils—Epoxie Sealed, Metal Encased
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#250-4E2 Momentary Contact	#250-4E1 Maintained Contact
Voltage 115V 60 cycle	
Inrush 0.165	0.340
Hold 0.136	0.256
Other voltages available	

Humphrey Products DIV.
General Gas Light Company Box 2008, Kalamazoo, Mich.

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$K = r/y = 15.00/1.5 = 10.0$

Consider the effect of the loading on Point "1".

f = i/y	y/x	λ_3 from chart	Load	(F) (λ_3)
0.3/1.5 = 0.2	1.5/0.75 = 2.0	4.8	F_1 = 104.02	499.3
0.6/1.5 = 0.4	1.5/0.75 = 2.0	9.8	F_2 = 110.52	1083.1
				1582.4

Using Equation 1:

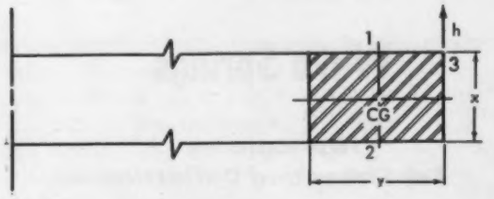
$$\Delta_1 = \frac{K^2}{E}\sum(F\lambda_3) = \frac{(10.0)^2}{(30)\ (10^6)}(1582.4)$$

$= 0.00527$ inch, radially inward

Because $\Delta_{CG} = 0$, the ring is being rotated about its center of gravity.

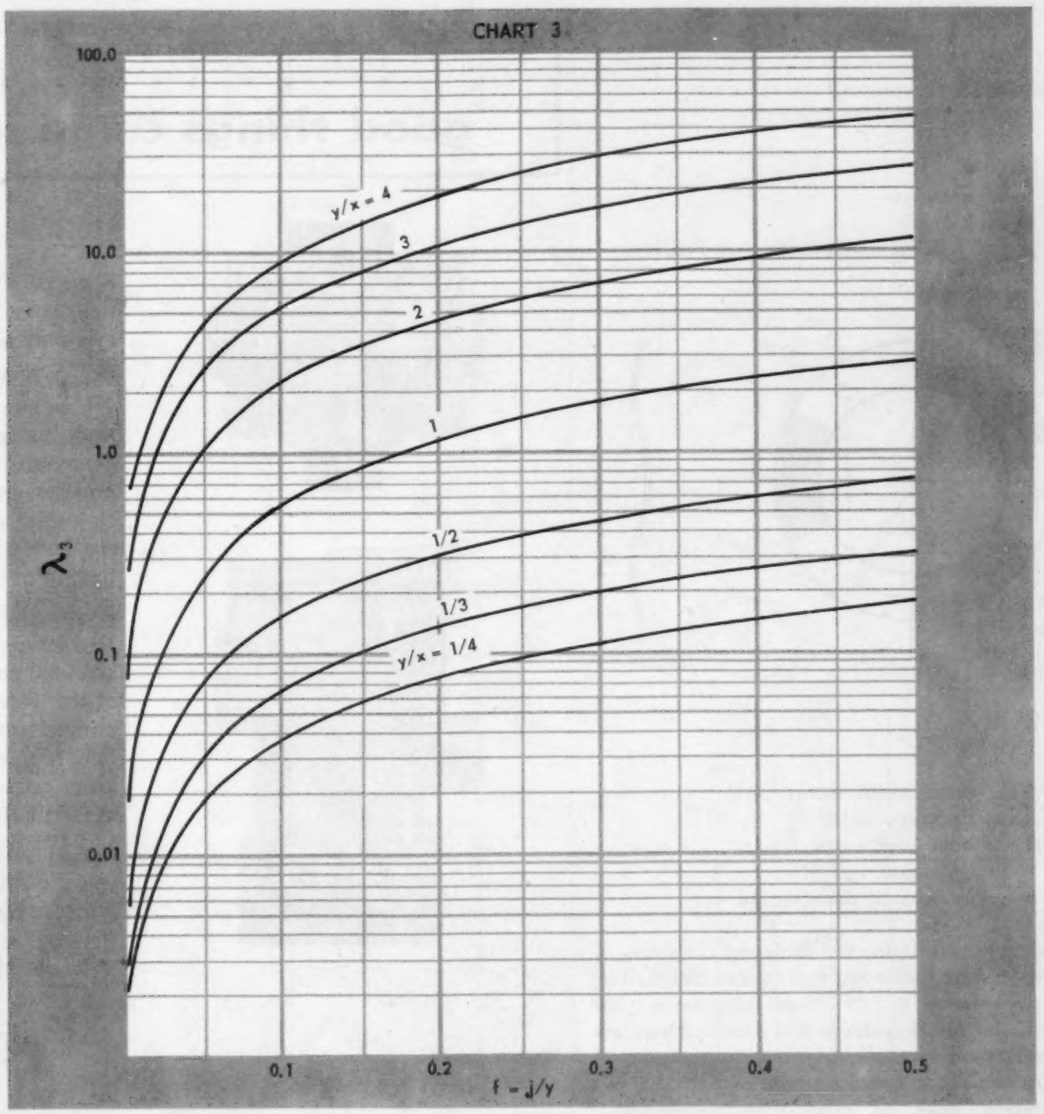
Next, determine the axial displacement of Point "3":

$$h = (y/x)\ \Delta_1 = (1.5/0.75)\,(0.00527)$$
$$= 0.01055 \text{ inch}$$



Minimum height of groove
$= 2\,(0.385) = 0.770$ inch

Because $0.770 > (0.75 + 0.01055)$, there will be no interference between ring and groove.



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Wave Springs

Nomograms For Stress and Deflection

Richard Wadler, Mechanical Engineer,
Raytheon Co., Bedford, Mass.

Nomogram I represents the equation:

$$S = (2.355)\ FD/bt^2N^2$$

Nomogram II represents the equation:

$$Y = 0.8216\ D^2S/EtN^2$$

Where:

S = stress, psi
F = load, lb
D = mean diameter, inches (see Fig. 1)

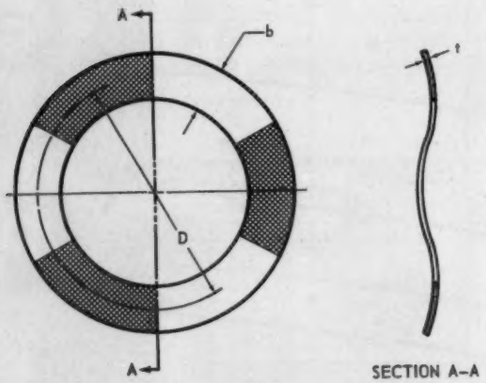
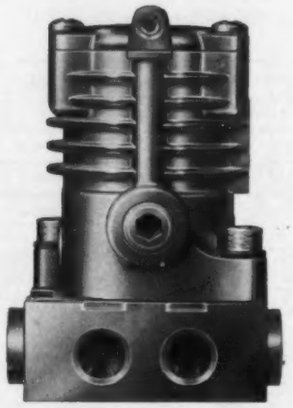


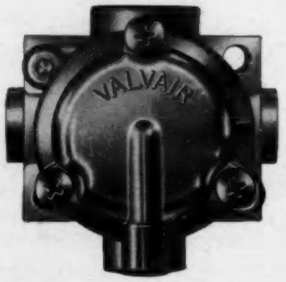
Fig. 1

b = radial width, inches
t = thickness, inches
N = number of waves
Y = deflection, inches
E = modulus of elasticity, psi

Example: Determine the stress and deflection of a wave spring subjected to a load of 250 lb. The mean diameter is 2.25 inches, thickness is 0.050 inch and radial width is 0.438 inch. There are three waves in the spring and the modulus of elasticity of the spring material is 16,000,000 psi. Solution: Find the stress using Nomogram I.



good things come in small packages!



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Bellows-Valvair
AKRON 9, OHIO
DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

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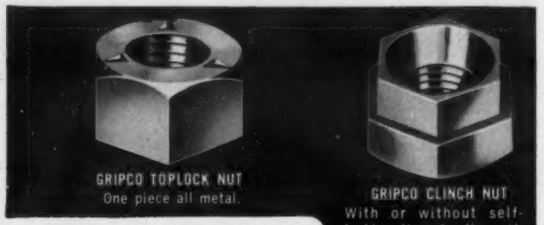

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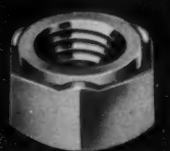

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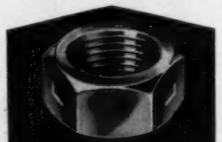

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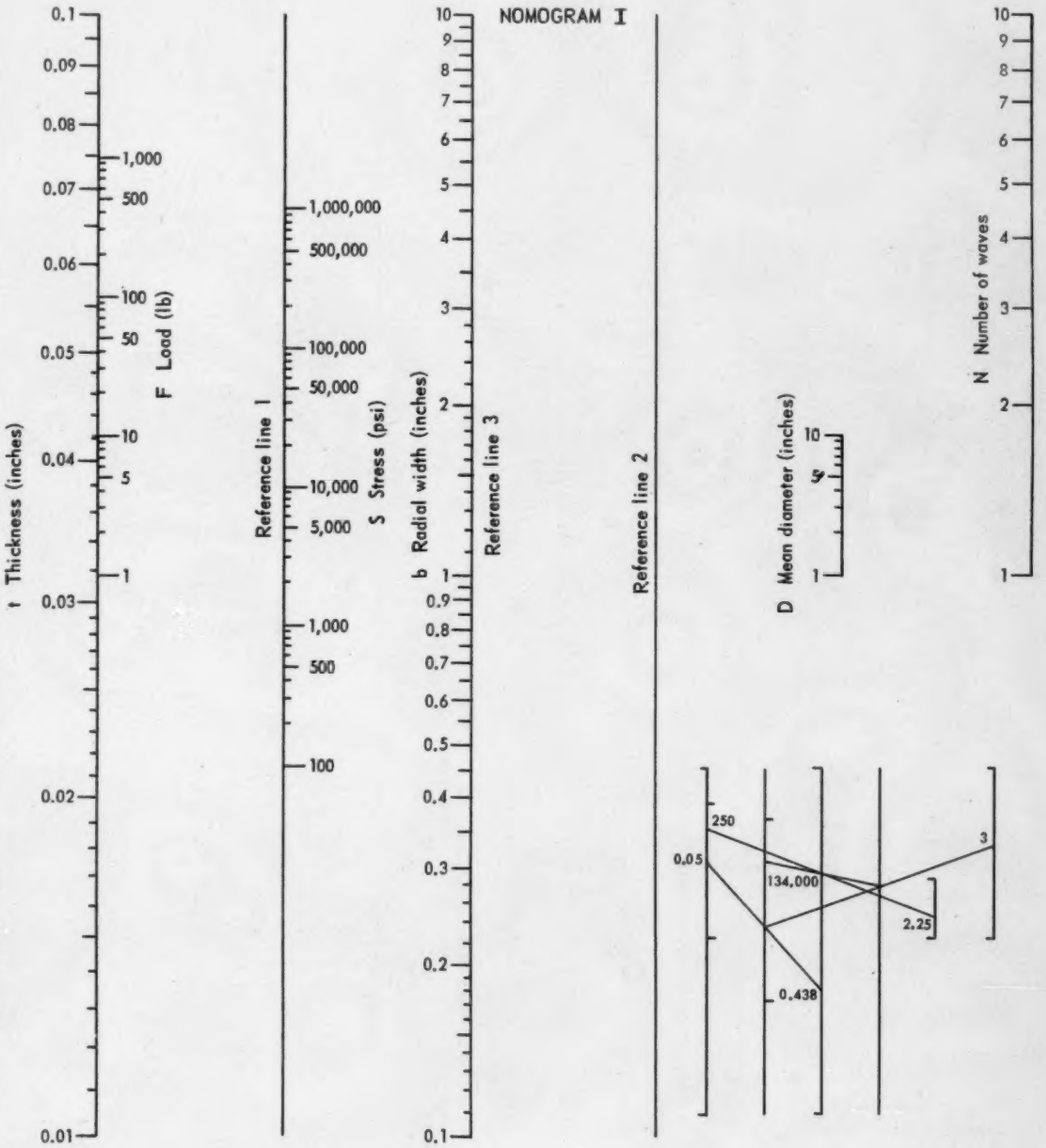
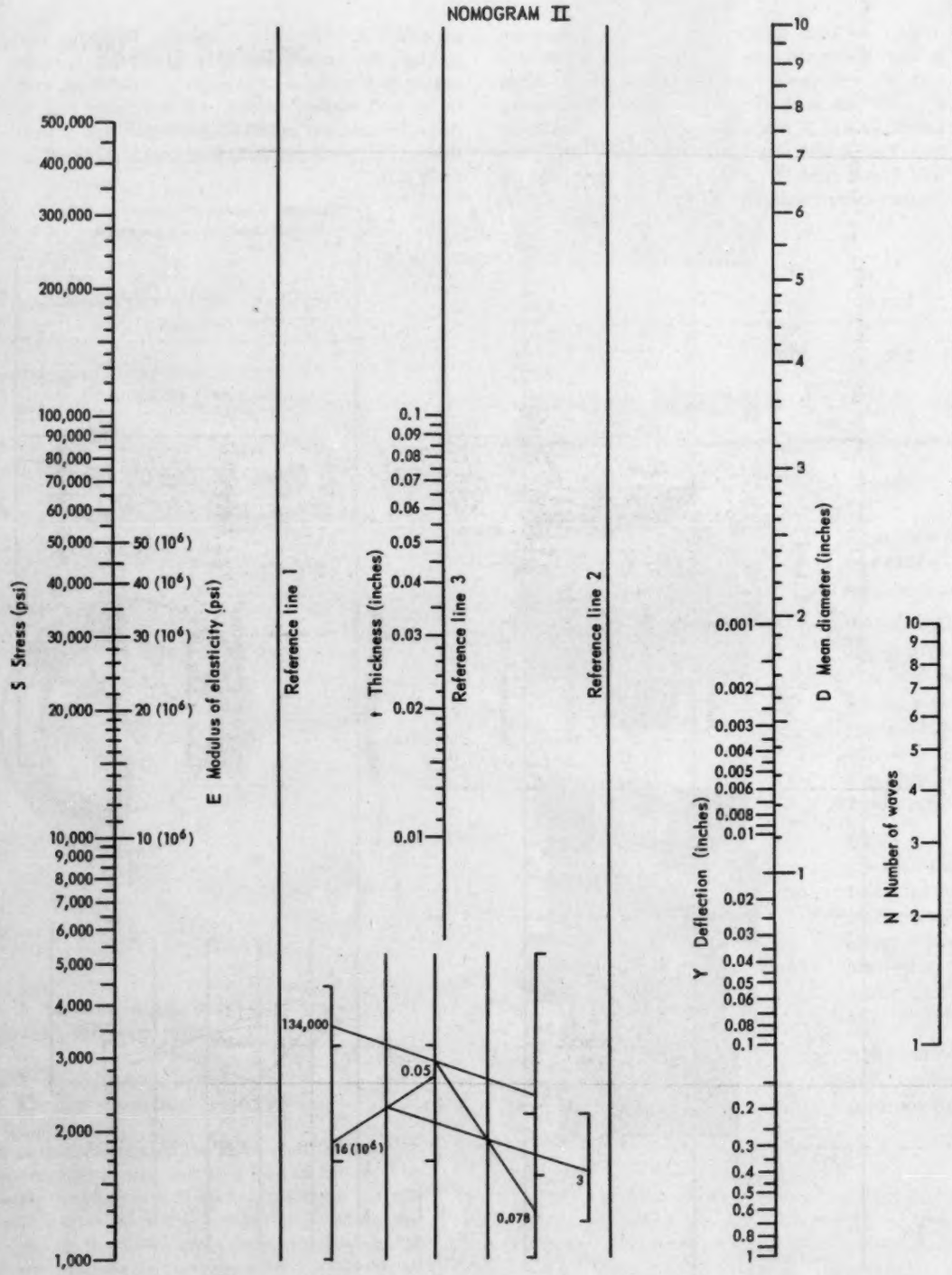
Align t = 0.050 inch with b = 0.438 inch, intersecting Reference line 1. Align this intersection with N = 3, intersecting Reference line 2. Align F = 250 lb with D = 2.25 inches, intersecting Reference line 3. Align intersection point on Reference line 2 with intersection point on Reference line 3 and read: S = 134,000 psi. Find the deflection using Nomogram II. Align E = (16) (10^6) psi with t = 0.050 inch, intersecting Reference line 1. Align this intersection point with N = 3, intersecting Reference line 2. Align S = 134,000 psi with D = 2.25 inches, intersecting Reference line 3. Align intersection point on Reference line 2 with intersection point on Reference line 3. Read: Y = 0.078 inch.





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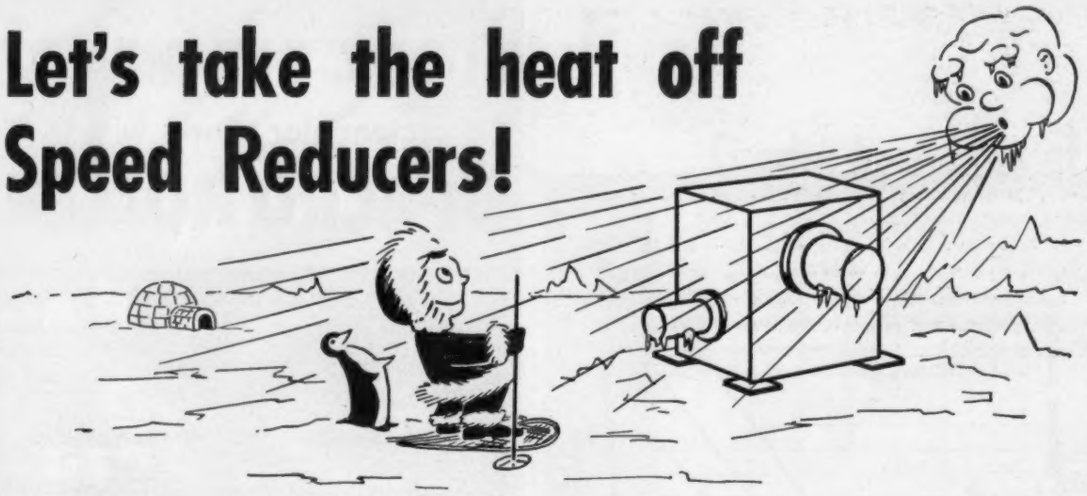
Let's take the heat off Speed Reducers!



A worm gear speed reducer is one of the toughest little customers in captivity. It reduces speeds day-in, day-out, with little complaint. While it works long and hard, it has limitations—set by ratio, center distance, RPM, mechanical and thermal HP ratings, etc. And, depending upon how precisely it was selected and fitted to the job requirements, it will do what it has to do.

But sometimes it's forced to play outside of its league. It must cope with job requirements that vary from here to there—normal 8 to 10 hour service without recurrent shock, the same length of service where there is some shock loading, continuous low-speed service and almost countless others. But the thing that really puts the pressure on reducers, the thing that's lurking in *every* set of job requirements—is h-e-a-t.

When you exceed the thermal capacity of a reducer for more than an hour or so, excessive temperature thins the lubricant resulting in wear; material, bearing and oil seal failures; etc. Of course, the proper lubricant will help but it can't cure the continuing problem of excessive heat.

So how can we lick this toughy? One way is to build the reducer housing oversize, big enough to radiate the heat away and keep temperatures down. But this type sticks out in aisles, louses up compact designs and barks shins. Then, we might try a smaller housing complete with fins on it to dissipate the heat. If this still doesn't work, another trick is to use a reducer with capacities and ratings a step above the ones we need. This is sending a man to do a boy's job. It's impractical, inefficient and costly. There *has* to be an easier, better, saner and cheaper way to do it. And there is!

In certain cases, where the size and type of reducer permits and where we can gain enough in thermal HP rating to keep heat generation in bounds, Cone-Drive Gears does it with fan-cooling.

What's that? Simple. Just add a fan to the worm shaft plus the necessary air shields, fan cover, etc., and presto!—heat is no longer a problem. The air shields direct the fan-pushed air over the fins on the lower portion of the reducer. The fins are shaped and spotted to guide the air stream where it is needed. Thermal HP ratings are boosted tremendously, as high as 147% above those of standard reducers in some cases! Those over-worked, over-heated reducers will now do the job you bought them to do.

Other advantages? They're here in abundance. The size of the reducer stays the same. All parts on a Cone-Drive fan-cooled reducer are 100% interchangeable with parts for standard reducers. Oil capacity is identical. Shields are quickly removed without disconnecting the reducer. (This is important where severe operating conditions make periodic cleaning necessary). The reducer can also be operated *without* fan-cooling just by taking off the fan and shields.

This simple addition to standard Cone-Drive HU speed reducers might be just your answer—might save you some money. Write for Cone-Drive's Bulletin CD-218. It will tell you all about the full line of Cone-Drive double-enveloping worm gear reducers as well as the fan-cooled kind. Cone-Drive Gears, Div. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

Circle 161 on Reader-Service Card for more information

Keyless Hub Shrink-Fit Chart

Richardson Gray, Design Engineer,
United Engineering & Foundry Co., Pittsburgh, Pa.

It is sometimes necessary to couple hubs to shafts without the aid of keys or other devices, relying entirely on friction to carry torque. This chart will be useful for quick evaluation of capacities of hubs of various proportions. The chart is based on Timoshenko's analysis of shrink fits in thick-walled cylinders (see reference).

For contact pressure:

$$P = (i/d)\,[E(r^2 - 1)/(2r^2)]$$

For hub tangential stress:

$$S_T = (i/d)\,[E\,(r^2 + 1)\,/\,(2r^2)]$$

Where:

- i = interference, inches
- d = hub bore, inches
- E = modulus of elasticity, psi
- r = hub OD/hub ID

Note: E is assumed 30 (10^6) psi. Modulus of elasticity and Poisson's ratio must be the same for shaft and hub.

Example:

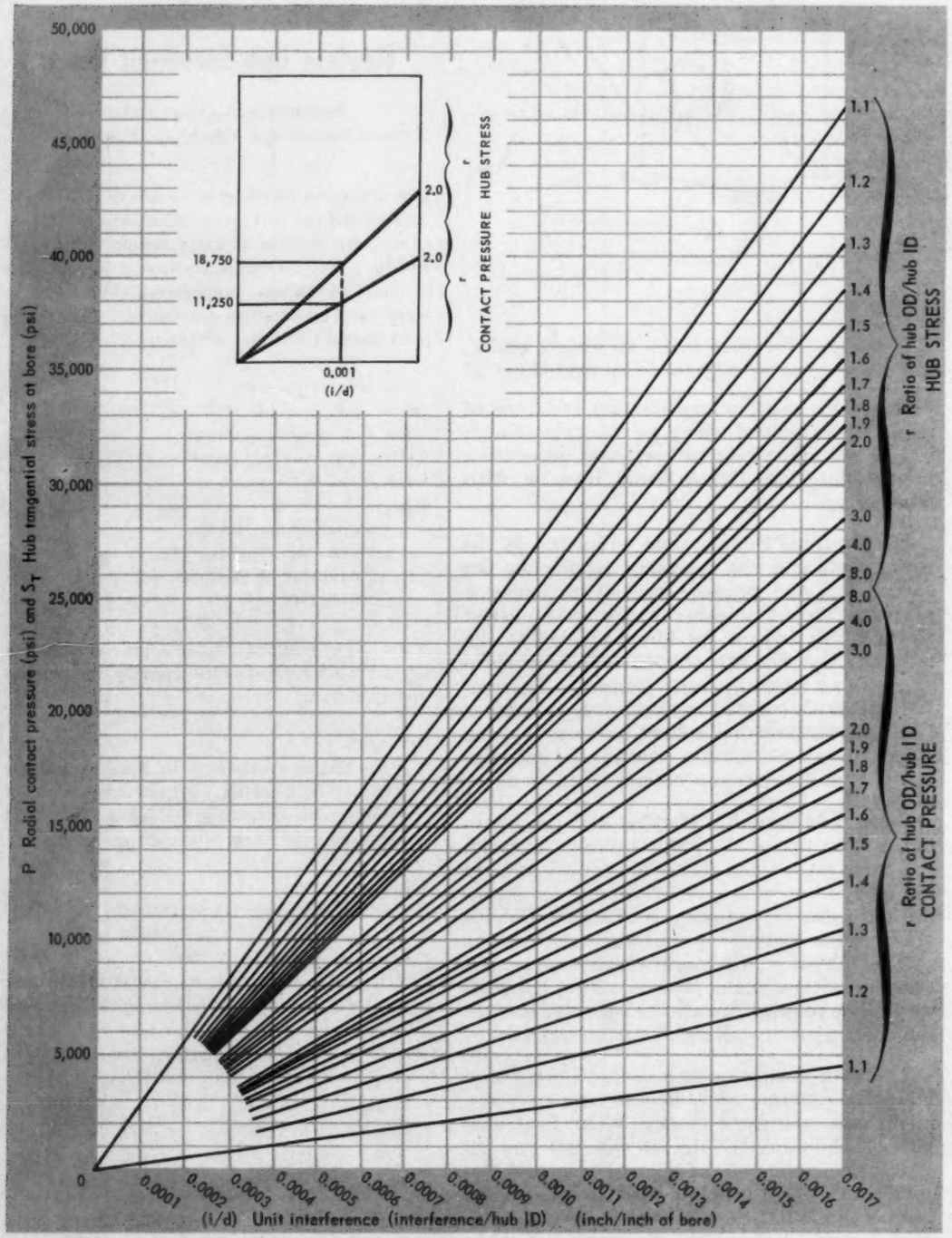
If the OD of a hub is to be 3 inches and the ID is to be 2 inches with an interference of 0.00015 inch, determine contact pressure and hub tangential stress when shrink-fitted.

Solution:

r = hub OD/hub ID = (3.0000)/ (1.5000) = 2.0000

(i/d) = (0.00015)/(1.5000) = 0.0010 inch/inch. Enter chart at $(i/d) = 0.0010$ and project vertically to $r = 2$ (contact pressure), then horizontally to the left and read $P = 11{,}250$ psi. To determine tangential stress, continue projection from $(i/d) = 0.0010$ to $r = 2$ (hub stress), then vertically to $S_T = 18{,}750$ psi.

"Strength of Materials", Part II, Third Edition, Section 41; S. Timoshenko; D. Van Nostrand Co., Inc., Princeton, N. Y.



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HOW TO FORM

a rectangular shape with the

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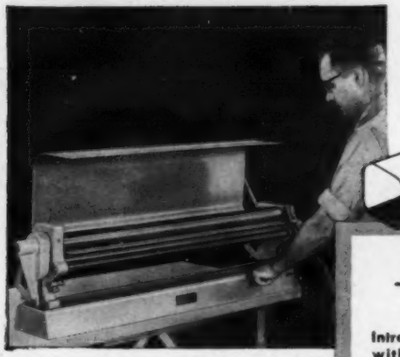

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Roll thru to desired point and engage Idler Roll.
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Continue bend until angle is formed.
3
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6

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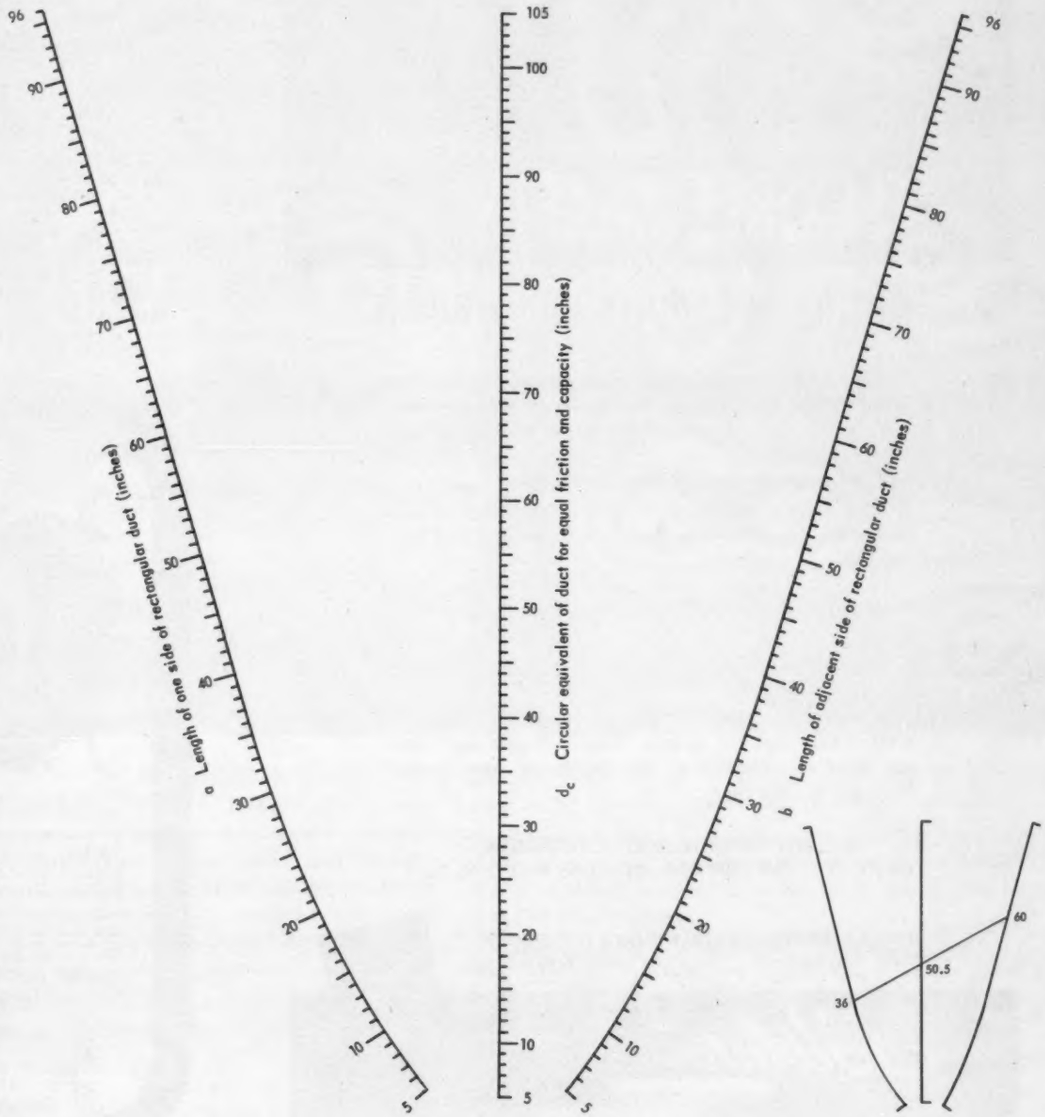
Circular Equivalent of a Rectangular Duct

F. Caplan, Kaiser Engineers, Oakland, Calif.

The nomogram solves the equation for the circular equivalent of a rectangular duct for equal frictional loss per foot and equal capacity:

$$d_e = 1.30\ [(ab)^{0.625}/(a + b)^{0.250}]$$

Example: What is the circular equivalent of a 60- by 36-inch rectangular duct?
Solution: Align a = 36 with b = 60 and read d_e = 50.5 inches.



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Chain-Selection Wall Chart 451

Choosing recommended chain pitch sizes for power transmission chain is simplified by this "quick-selection" wall chart. Printed on heavy paper suitable for easy wall mounting or filing, the two-color chart lists design horsepower on the vertical axis, rpm speeds for the small sprocket on the horizontal axis. Simply locating the intersection of any two selected combinations of these factors automatically gives the recommended chain pitch size. Foote Bros. Gear & Machine Corp., Dept. MJ, 4545 S. Western Blvd., Chicago 9, Ill.

1961 Film Catalog 452

More than 350 free films available for loan to school and adult groups for 1961 are described in a new catalog. Entitled "Pocket Guide to Free Films", the catalog is published twice a year, in February and in August, to list new movies as well as to re-offer titles already available. Most films described in the catalog are in color. All are 16mm-sound movies, varying in length from ¼ to ½ hr. They are obtainable from 30 Modern Talking Picture Service libraries in principal cities throughout the U. S. Modern Talking Picture Service, 3 E. 54th St., New York 22, N. Y.

Hose-Assembly Reference Guide 453

A handy reference bulletin to be used as a quick guide to hose-assembly numbers. Bulletin IEB-53 covers the various categories of end fittings (JIC and SAE). The bulletin also describes hose types to be used with each type of fitting. Aeroquip Corp., Jackson, Mich.

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Drafting Aids Chart 454

This is a six-page, illustrated table which includes all of the precut pressure-sensitive shapes and narrow tapes required to make paste-up printed-circuit drawings that will conform to military specifications, together with many new non-military configurations. It provides convenient illustrated cross-reference between corresponding sizes of doughnut-type pads, teardrop pads and twin pads. Valuable information is provided regarding the purposes for which the different kinds of pressure-sensitive tape are commonly used on printed-circuit drawings and for making prototypes—black, white, black-on-white, translucent-red and electroplaters' vinyl. By-Buk Co., 4314 W. Pico Blvd., Los Angeles 19, Calif.

Potting Compound 455

A four-page bulletin describes recently developed clear silicone potting compound (LTV-602). Bulletin CDS-280 lists complete properties of the compound and outlines a simple procedure for preparing it for use. Publication is vividly illustrated with many photos. General Electric Co., Silicone Products Dept., Waterford, N. Y.

Drafting Film 456

The new line of "Ark-A-Tex" drafting film is described in a sample folder. Arkwright Finishing Div., Arkwright-Interlaken Inc., Fiskeville, R. I.

Thermoplastics Comparison Chart 457

Gives mechanical and electrical properties of "Lexan", "Delrin", "Zytel 31", "Zytel 101" and "Implex A", showing ASTM test method for each property. Chart is suitable for wall hanging. A. L. Hyde Co., Grenloch, N. J.

Ceramic Cutting Tools 458

This 28-page, three-hole-punched folder gives properties data, specifications and prices on throw-away inserts, heavy-duty button inserts, solid inserts, unground blanks, single-point tools and tool holders. Carborundum Co., Dept. BMD, P. O. Box 337, Niagara Falls, N. Y.

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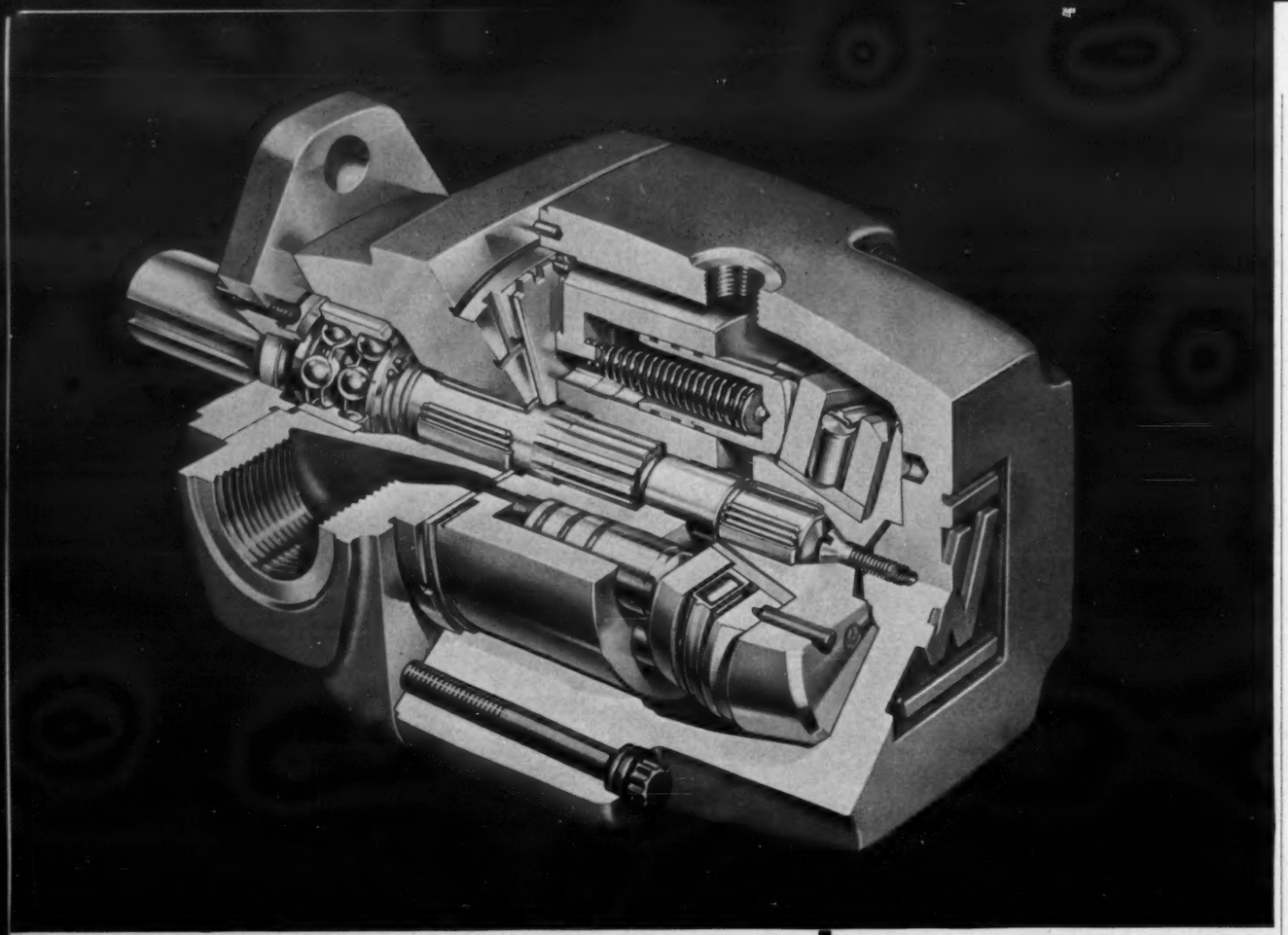

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The C3F Series can be used as a hydraulic motor (remote rotary locations, screw feeds — anywhere an electric motor might be used) or as a hydraulic pump . . . wherever high torque and smooth, steady force are required. It is available in four sizes — from .72 to 1.81 cubic inches per revolution. Capacities range from 3.3 to 8.5 gpm at 1200 rpm; 7 to 18 gpm at 2400 rpm.

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7 to 18 gpm at 2400 rpm

Speeds: to 3000 rpm

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Torque range (theoretical): four sizes; 11.52, 17.28, 23.04, 28.80 inch pounds per 100 psi

Output: 5.5 to 14 hp. at 3000 psi at 1200 rpm
11 to 28 hp. at 3000 psi at 2400 rpm

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LITERATURE

Variable-Speed Motor Drives 459

An 88-page publication covering a complete line of "Vari-Speed Motordrives", ¼ through 40 hp. Data includes full rating tables with new additional output speeds. Dimension diagrams and charts for more than 100 different assemblies, new higher overhung load and new controls are also included. Reliance Electric & Engrg. Co., 24701 Euclid Ave., Cleveland 17, Ohio.

Industrial Instrumentation Transducers 460

Describes advanced measurement techniques for modern control and computer systems. This fact-filled, 23-page booklet reviews system applications of strain-gage transducers. Performance curves of the model P713 transducer and calibration technique schematics are included. Statham Instruments, Inc., 12401 W. Olympic Blvd., Los Angeles 64, Calif.

Resolvers/Synchros 461

A handy, quick-reference catalog compiling some 200 resolvers and synchros. Ten basic parameters are covered for each unit. A fast reference to the input voltage, impedance and transformation ratio values will assist the design engineer in the application of these high-precision servo components. Typical views of the units, dimensional drawings and circuit diagrams also are included to aid in proper selection. The units are grouped in terms of size and winding compensation. American Electronics, Inc., Instrument Div., 903 W. Jefferson Blvd., Culver City, Calif.

Industrial O-Rings 462

Gives laboratory data on four compounds especially developed for industrial application. The four-page bulletin illustrates some of the unlimited applications for O-rings and gives extensive details on quality control procedures. Additional data on physical and chemical properties of O-rings and price class information are presented, along with photographs and brief descriptions of other products. Stillman Rubber Co., 5811 Marilyn Ave., Culver City, Calif.

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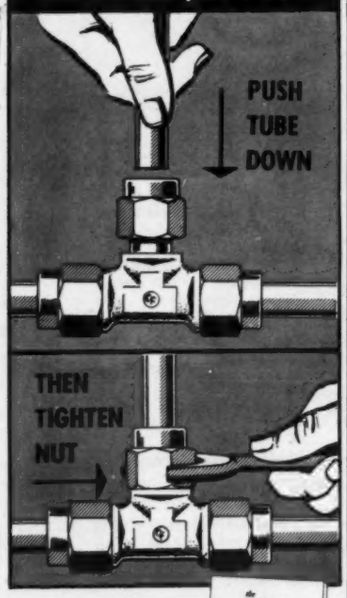

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Precision Spacers And Posts **463**

These often-needed hardware items are described, with prices, in a 12-page catalog. Both metallic and non-metallic items are included in more than 1000 varied types. Several kits are included, offering wide assortments of components for experimental uses. Angler Industries, Metuchen, N. J.

Power Supply Components **464**

Lists almost 900 stock transformers for industrial applications. The catalog is cross-indexed to assist the engineer in quickly locating the desired listings. Each transformer is fully described and illustrated. Detailed dimensional information as well as complete electrical specifications are given for all units. Where applicable, performance curves are included. Chicago Standard Transformer Corp., 3501 W. Addison St., Chicago 18, Ill.

Quick-Disconnect Couplings **465**

A quick reference to the basic valving and connection principles of quick-disconnects is available in a handy, eight-page booklet. Summarized are the advantages and limitations of specific valving and connection concepts. Basic methods of connecting couplings also are described and illustrated. Aeroquip Corp., Jackson, Mich.

Miniature Display Lights **466**

Described in this two-page publication are high-quality display units which provide flexibility of use through a selection of lens and body colors, lamp types, internal resistors and terminal options. Diagrams show full-sized outline drawings with mounting dimensions and electrical connections. Complete physical specifications and ordering information are listed for the MDL series. Transistor Electronics Corp., 3357 Republic Ave., Minneapolis 25, Minn.

Silicone-Insulated Wire **467**

A four-page illustrated bulletin describes and provides data on the various kinds of silicone-insulated cable. Boston Insulated Wire & Cable Co., 63 Bay St., Boston 25, Mass.

Integral Motors **468**

Included in this eight-page publication are specification and availability tables, as well as special construction features of aluminum integral motors. Franklin Electric Co., Inc., Bluffton, Ind.

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ON GUARD! Midas, America's newest and heaviest space vehicle, represents another step forward in the Air Force's Satellite Program. On Mark congratulates the Lockheed Missiles and Space Division for its part as prime contractor on Midas. This satellite is an advanced version of the Agena vehicle, and we at On Mark are proud to be members of the team that has compiled an unprecedented record in the Discoverer-Agena program. The successful launchings during this program have been accomplished with the use of On Mark couplings, including the flow of fuel (UDMH) into the Midas. For the exacting requirements of an expanding universe, On Mark is on guard to help solve your difficult coupling problems. On Mark Couplings, Inc., 4440 York Boulevard, Los Angeles 41, California. CLinton 4-2278

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GISHOLT MACHINE COMPANY incorporates McGILL CAMROL® bearing accuracy into tooling set-ups

Gisholt Machine Company takes advantage of the cost and performance features of CAMROL CF series bearings, (with integral stud), on a group of standard bar tools for mounting on the turrets of Gisholt Masterline Turret Lathes. A representative tool of this group is the Multiple Cutter Turner shown.

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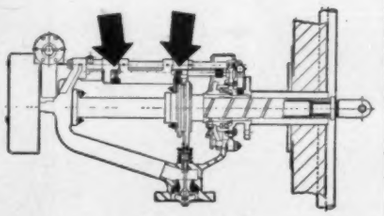

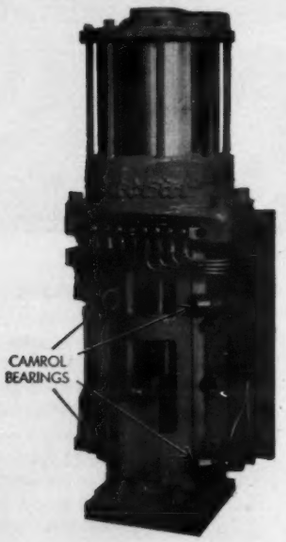

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The anti-friction welder head unit, shown, is one of the several applications of McGILL CF CAMROL bearings in Federal Machine and Welder Co. equipment. CAMROL bearings are used in weld heads, transfer slides and various other uses where a precision, smooth, uniform movement is desired. Low cost, uniform quality, excellent performance and exceptional length of life are benefits gained in eleven years of use of CAMROL bearings.

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Zero G Human And System Performance

Major Edward L. Brown,
Air Force Ballistic Missile Div., (ARDC)

A research program aimed at determining human and system performance during zero G took place for the first two years in a C-131B transport-type airplane while it was flying a Keplerian trajectory. This airplane can produce about 15 sec of zero G. The research program recently has been accelerated by the addition of a KC-135, which will produce about 30 sec of zero G. This article is a summary of a major portion of the work conducted in the C-131B.

Research Areas

The research areas that were investigated during zero G include the following:

1. Human performance on motor and mental tasks.
   a. Normal flying performance and procedures during zero G.
   b. Performance on actual emergencies during zero G.
   c. Human performance on experimental tasks.
2. Locomotion of individual humans inside large space vehicles.
3. Locomotion of individual humans outside space vehicles.
4. Human perceptive orientation during zero G.
5. Behavior of liquids during zero G.
6. Fluid transfer problems during zero G.
7. Heat transfer problems during zero G.

Normal Flying Performance And Procedures

The degree of accuracy in flying the trajectory that can be achieved by an experienced pilot is better than ± 0.05 G. This is using an especially modified mechanical instrument. Preliminary results with an especially designed indicator employing a spherical cork floating in a plastic container of water indicate that we can expect to come even closer to absolute zero G in the future.

Performance on Actual Emergencies During Zero G

Actual emergency situations have occurred on two occasions. Both of these involved overspeeding propellers, an item that is potentially very

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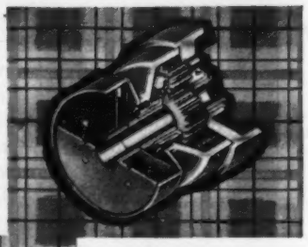

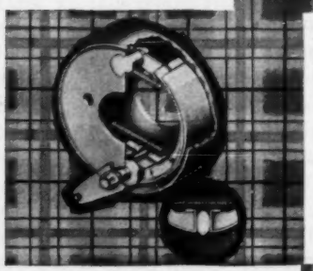

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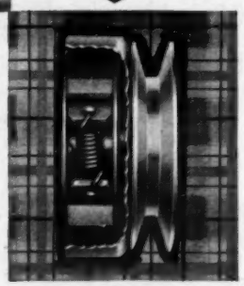

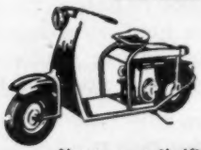

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hazardous. The first time this occurred, it came as a complete surprise to the two pilots, one of whom was on his first zero G flight and had acted as co-pilot for three trajectories. On the fourth trajectory, he acted as pilot and over-controlled, unknowingly putting the airplane into a trajectory with a very slight negative G component. About two-thirds through the trajectory, both propellers began to overspeed. The pilots, while flying in essentially a zero G condition, had about 2 sec in which to analyze the situation and perform the correct action, feathering the propellers—which they did. One of the propellers, however, because of the complete loss of oil pressure in its system, continued to overspeed, even though the pilot had taken correct action. It was later determined that close monitoring of the oil pressure provided more lead time for initiating the propeller feathering and on a subsequent flight in which a propeller began to overspeed, it was brought under control before it approached the danger limits. These incidents provide us with some evidence that people can function correctly in an emergency situation during zero G. With experience and training in specific emergency situations, they can anticipate trouble and take corrective action before the emergency becomes serious, just as they can during normal G conditions.

Human Performance On Experimental Tasks

Several experiments on motor tasks have been performed during zero G. These have involved rapid movements of levers and switches, and have been performed with tight safety belts and with loose safety belts. In general, with a tight safety belt, a man can perform as accurately and as quickly during zero G as during normal G. The major effect of a loose safety belt is to cause him to use one hand to hold onto any convenient solid apparatus to hold himself in position while he performs the task with the other hand. Relatively little force is required to operate the switches and levers involved in this experiment. It is expected that as the force for moving levers increases, the requirement for a tight safety belt increases. The motion pictures taken of subjects performing during zero G also indicate the desirability for having a stirrup-type arrangement for the toes to prevent the feet from rising during the performance of motor tasks. While it has not been investigated, it appears that something which can assist in holding the feet solidly in place and about 12 to 14 inches apart, as well as a tight safety belt, would be of assistance during motor tasks requiring large forces to be applied through the arms and hands.

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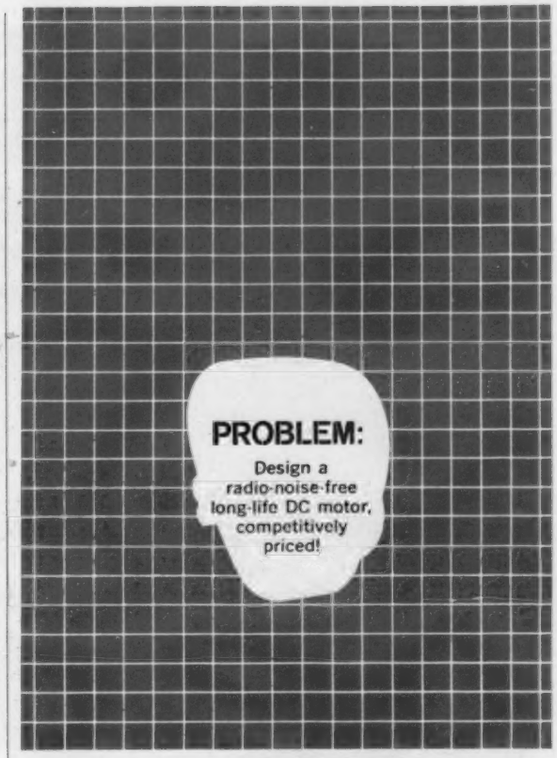

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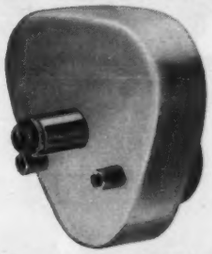

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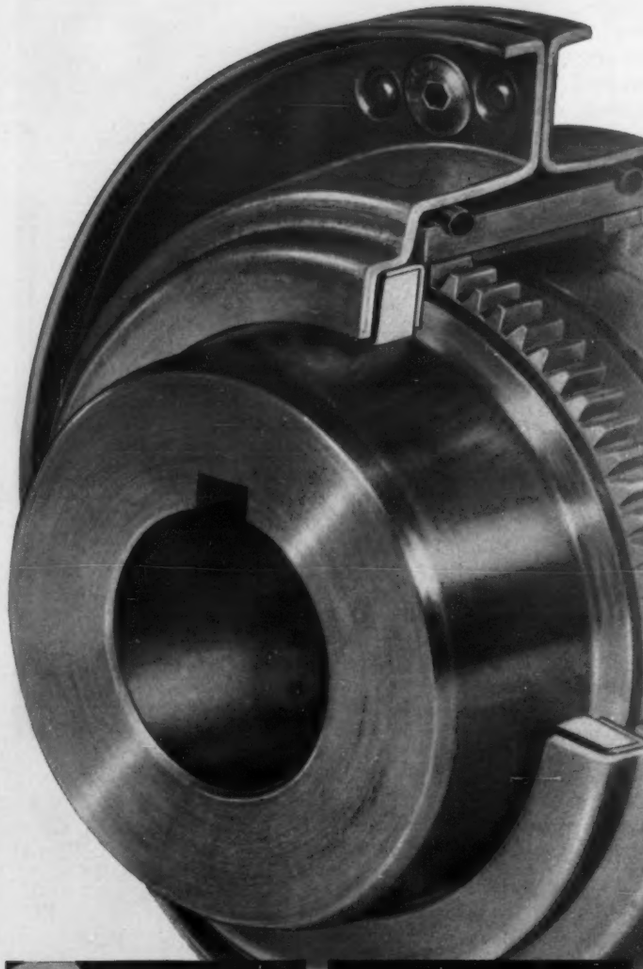

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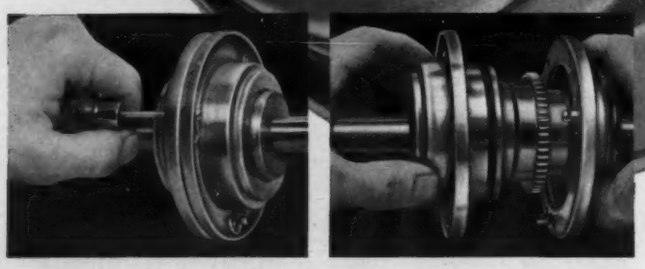

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System Performance . . . *Cont.*

Locomotion of Individual Humans In Space Vehicles

When space vehicles become large enough that men will have to move around inside them during normal operation, the problem of locomotion arises. Normal walking is impossible, of course, because, without G, the friction we use in ordinary walking is not present.

The methods of locomotion for individuals in space vehicles that have been investigated during zero G are:

1. Pushing off walls and floating across open areas, and
2. Walking with magnetic or suction-cup shoes.

For travel inside space vehicles, simply pushing off walls, floors or ceiling and floating to the desired location seems to be the most feasible and easiest means of locomotion. It takes very little time to learn to push with a low enough force that the hands and arms can stop the body without difficulty. The problem of getting one's center of gravity and line of thrust aligned and pointed toward the desired destination takes several trials to solve, but cannot be considered particularly difficult. One my start to tumble, by having the line of thrust pass through the body at a point other than the center of gravity, but usually the rotation is slow enough that it is easily controlled and stopped when a wall or other solid object comes within reach. It appears that recessed handholds would be of considerable aid in this type of locomotion. As a safety measure for those employing this method of locomotion, it is recommended that sharp corners and other protuberances in the areas in which men are likely to travel by floating be padded. Of the methods tested so far, this free-floating appears to be the easiest and most carefree method of travel, not requiring mechanical aids, that has been devised by man.

Walking during Zero G

The use of both the suction cup and magnetic shoes was investigated at about the same time. During the first trials, the shoes with the suction cups employed one cup on the heel of each shoe. While it was possible to walk on the ceiling during zero G by using these shoes, it was very apparent that smaller suction cups on the forward portion of the sole were necessary. Without suction cups on the forward part of the shoes, when one applied force to his ankle to force the body forward in preparation for a step, the front part of the shoes pulled away from the surface and there was no force available to get the body started forward. Even with forward-placed suction cups, walking was difficult. This is not con-

sidered a satisfactory method of providing positive contact with a surface to facilitate walking during zero G.

The magnetic shoes, or more properly, magnetic slippers, had permanent magnets attached to the soles. The first few times the shoes were used, the magnets in each shoe had about five lb of attraction. While it was possible to walk on the ceiling with these shoes during zero G, it was difficult. The attractive force was so light that it was very easy to push one's self away from the ceiling and lose contact with it completely. For our next model, magnets were installed that give an attraction of about 18 lb. This is expected to reduce the problem of pushing away from the ceiling. These have not yet been tried during zero G.

To reduce the problem of having to exert an undesirable amount of force to separate the magnetic shoes from the ceiling and yet have enough force to hold one securely in position, a pair of electromagnetic shoes was designed and built. These shoes are powered by two flashlight batteries and have a limit switch located so that as soon as one lifts the heel, which is easy to do, the circuit is broken and the shoes will readily come off the surface. They have a potentiometer in the circuit so that the attraction can be varied from zero to 60 lb. These have recently been completed and have not been tried during zero G conditions.

Locomotion of Humans Outside Space Vehicles

Locomotion of individuals outside their space vehicle will be required for tasks such as inspecting and repairing the exterior of their own vehicle, transferring supplies or personnel to adjacent orbiting vehicles, servicing unmanned communications and other satellites, and for the building and repairing of large space stations.

For walking on the immediate surface of the vehicle, if the vehicle surface is ferrous or if magnetic particles are embedded in pathways, the magnetic, or more preferably electromagnetic, shoes appear to be suitable. One would always have a line attached to himself and the ship, of course, as a safety measure to prevent accidentally drifting off into space.

Locomotion of individuals outside space vehicles probably will be based on the use of a reaction propulsion-type unit. This type of device can have a relatively low thrust and still be quite suitable because of the unique space flight conditions of no air and no gravity.

Behavior of Liquids during Zero G

Study the behavior of liquids during the 15-sec zero G periods is a problem. If the plane is

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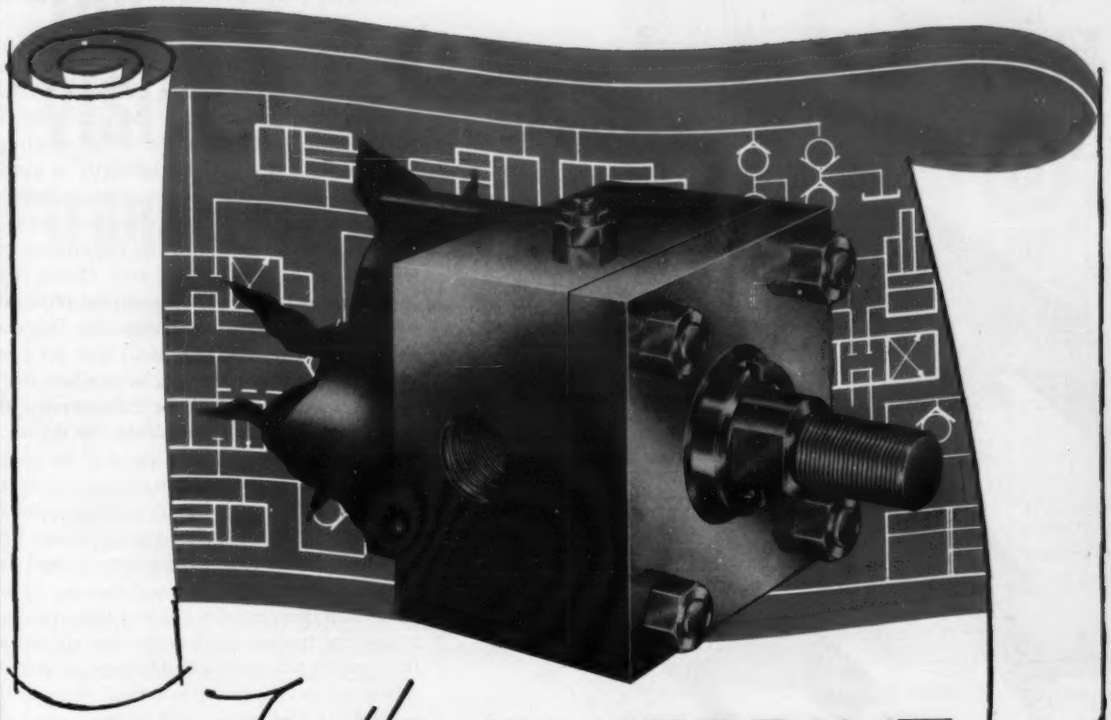

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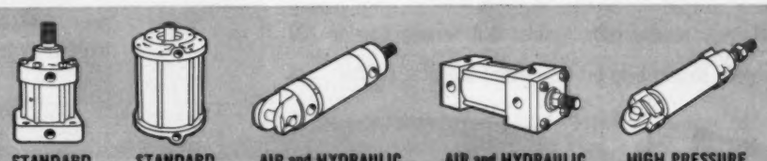

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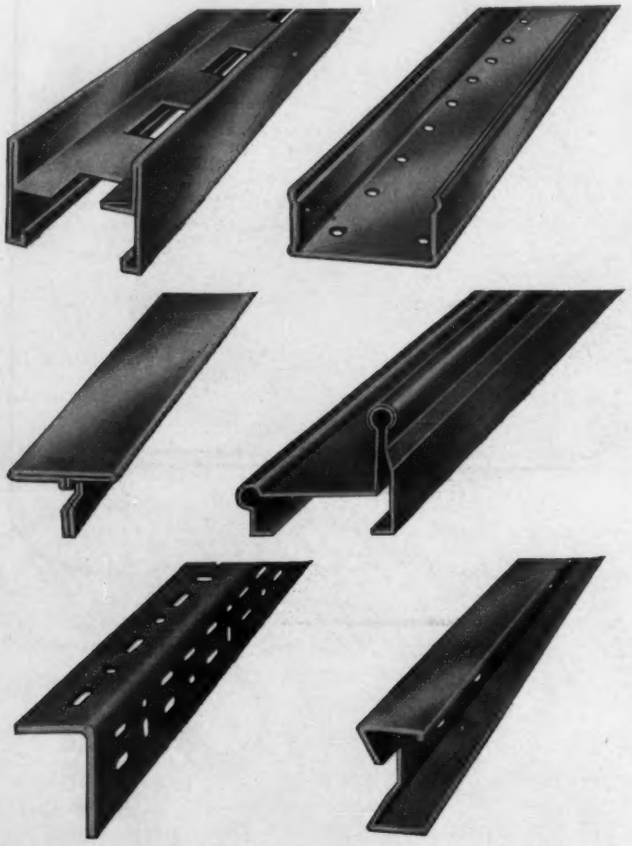

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System Performance . . . Cont.

brought slowly to zero from a positive G condition, nothing will change unless a mechanical force of some kind is imparted to the liquid. However, bringing the plane to an absolute zero G both vertically and horizontally is extremely difficult and occurs quite infrequently. One method of achieving a near-absolute zero G made use of a sphere, containing the experiment, which was suspended by cables and chains from a bridge-like structure that could be motor-driven up and down the cabin to neutralize longitudinal accelerations of the airplane. The plan was to slack off on the cables and chains when the plane first achieved zero, and then, by driving the retaining structure up and down the cabin, allow the sphere to stay at zero but still be restrained by the cables so as to maintain control and keep it from crashing into the sides or top of the cabin. In practice, however, this system did not work. It was found that the momentum caused by the rapidly slacking chains was sufficient to impart an acceleration to the sphere, thus voiding the reason for having the free-floating sphere within the retaining framework. The best results are obtained when the sphere is turned loose in the aft portion of the cabin, and several men, experienced in handling themselves at zero G, monitor the behavior of the free-floating sphere and see that it does not damage itself or the airplane. This method has been adopted for use in the KC-135 and appears to be the most feasible method for obtaining zero G for periods of more than 2 or 3 sec. Until a research laboratory is set up in orbit, this appears to be the best situation for studying the effects of zero G on liquids.

Heat Transfer Problems during Zero G

Those who are familiar with standard heat transfer equations for liquid systems will recall that G is involved in the equation. Not only is it in the equation, but it is involved in the action to the extent that when it drops to zero, the heat transferred drops to zero. Obviously, when dealing with the problem of heat transfer during zero G, the basic equations must be modified or means must be found to introduce an artificial G to the heat transfer system. Since the work on the heat transfer problem started only recently, there are as yet no results to report. One apparatus for experiments designed to help define the problem area was found to be unsuitable on one of the first flights, so it was being redesigned at last report.

Abstracted from a technical paper entitled "Human and System Performance during Zero G"; SAE No. 2301; Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

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S-sequence
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MAX. PRESSURE
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3 - 3,000 psi
6 - 6,000 psi

BODY DESIGN
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GPM
10 20 30

DESIGN NO.

DRAIN
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2 - external

ADJUSTMENT TYPE
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Copies of these papers may be obtained by writing to technical society indicated. Addresses follow last item.

RELIABILITY IMPLEMENTATION IN ENGINEERING DESIGN; *I. Doshay, Aerojet-General Corp., Azusa, Calif.; SAE No. 235A; $.75; to SAE members, $.50.*

Proper engineering design involves adequate consideration of all pertinent parameters. Design parameters involving measurement and fulfillment of required performance during specified periods of operation are important. These factors constitute the newly recognized engineering technology of reliability. Techniques of data development through statistical reduction methods are illustrated.

PROGRESS IN SPACE HEATING WITH SOLAR ENERGY; *C. D. Engebretson and N. G. Ashar, Massachusetts Institute of Technology, Cambridge, Mass.; ASME No. 60-WA-88; $1; to ASME members, $.50.*

The MIT Solar House IV was designed and built to extract part of its space heating and hot-water load from the sun. The house operated successfully during the winter of 1959-1960. The total solar incidence on the collecting area during the season was 122.4 million Btu, of which 32.4 million Btu were of too low an intensity to justify attempted collection.

COMPUTER DESIGN USING INDEX ARITHMETIC; *Aviezri S. Fraenkel, University of California, Los Angeles, Calif.; AIEE No. 60-1228; $1; to AIEE members, $.50.*

Consideration of a system in which two numbers entering a multiplication are transformed into indices. These indices are added in their own number system. The sum, when converted back, gives the product. Properties of indices corresponding to Mersenne Primes are derived and used to save mechanization or storage requirements for conversion of numbers into indices and vice versa.

PNEUMATIC SERVO STEERING; *J. L. Harned and J. Robertson, Jr., Research Labs., General Motors Corp., Detroit, Mich.; No. GMR-301; presented at the National Conference for Industrial Hydraulics, Chicago, Ill.*

Pneumatic servo steering for vehicle directional control is evaluated from both theoretical and experimental standpoints. Basic requirements of vehicle steering are set forth to establish baselines for the pneumatic servo specifications. A prototype vehicle installation is described. Major emphasis is placed on achieving satisfactory steering performance at a relatively low pneumatic supply pressure.

REVIEW OF AIRCRAFT INSTRUMENT PROBLEMS; *G. T. Gebhardt, Boeing Airplane Co., Renton, Wash.; SAE No. 247A; $.75; to SAE members, $.50.*

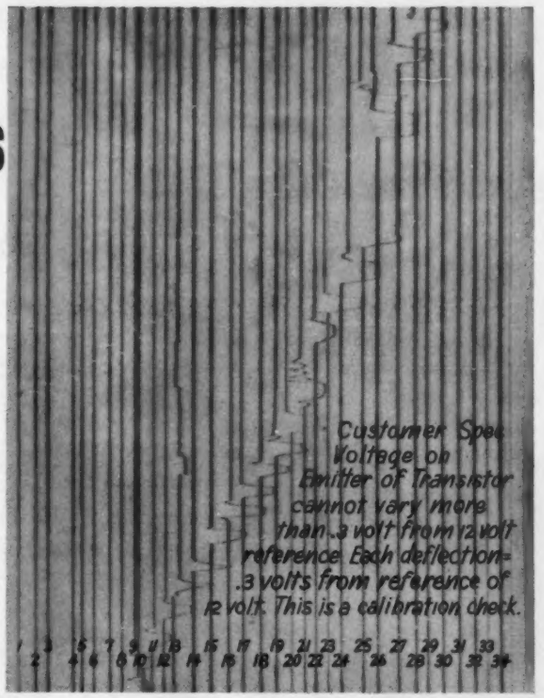
Reliability is the biggest problem cocurring with the instrumentation of jet transports. Accuracy problems may have to be solved by use of more complex and expensive instruments. In the case of primary instruments, such as altimeters, use of more complex instruments should be approached cautiously by using them in conjunction with proven instruments.

American Institute of Electrical Engineers, 33 W. 39th St., New York 18, N. Y.
The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.
Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

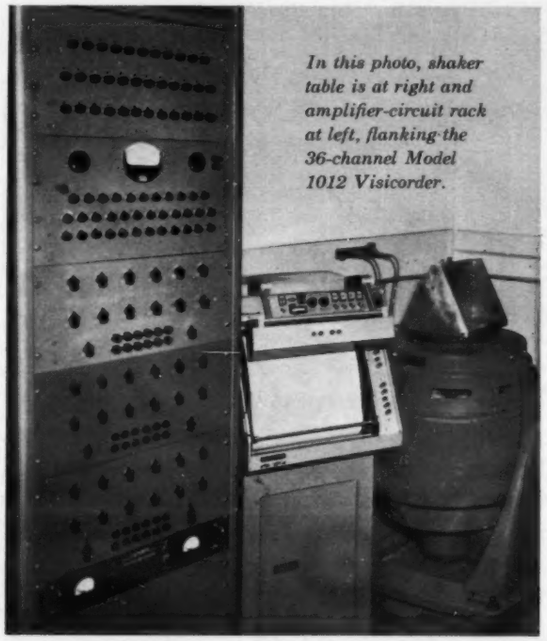
The VISICORDER records transistor torture

Transistors often have to work under incredibly severe environmental conditions. Production-testing them gave engineers at Honeywell's Semiconductor Division a chance to exploit the great versatility of the 36-channel Visicorder oscillograph Model 1012.

A certain order of transistors had to withstand vibrations of 10G at 10 to 2,000 cps without failing during the test or as a result of it. A standard test had been to measure the transistor's performance, next subject it to non-active vibration (not in any circuit), and then re-measure. This approach was obviously deficient as it did not reveal *operating* characteristics during test, nor did it disclose *intermittent*-type failures.



Unretouched record of vibration test on 36 transistors, each active in its own circuit during test.



In this photo, shaker table is at right and amplifier-circuit rack at left, flanking the 36-channel Model 1012 Visicorder.

The customer's quality requirements were stringent (AQL = .4%) and the large test sample required ruled out the use of an oscilloscope. The 3-hour test would have made a battery of scopes and operators necessary; transient defects would be missed due to eyestrain, fatigue, etc.

The Model 1012 Visicorder was chosen for the task as it simultaneously measures and records 36 channels of test information throughout the test period. The Visicorder instantly and directly records transients, no matter how random.

A Visicorder record like this is always a welcome supplement to your test data—your customer will be able to read it quickly and with full understanding. And it is a *permanent* record which *he* can show to *his* customer, if necessary.

For further information on how Visicorders can help to solve your instrumentation problems, contact your nearest Honeywell sales office without delay. Or write for Catalogs HC 906, 1012, 1108 and 1406, to:

Minneapolis-Honeywell, Heiland Division, 5200 East Evans, Denver 22, Colorado, SK 6-3681—Area Code:303

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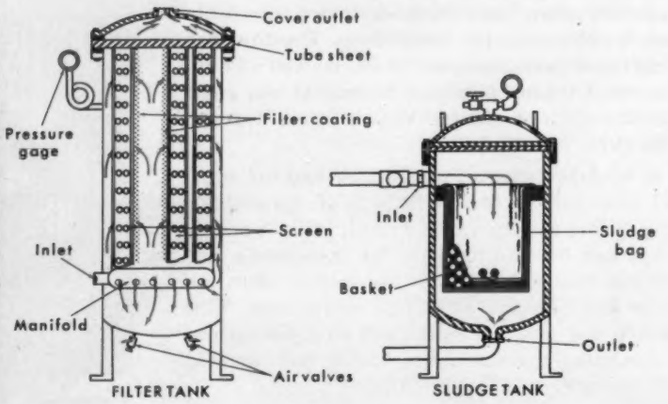
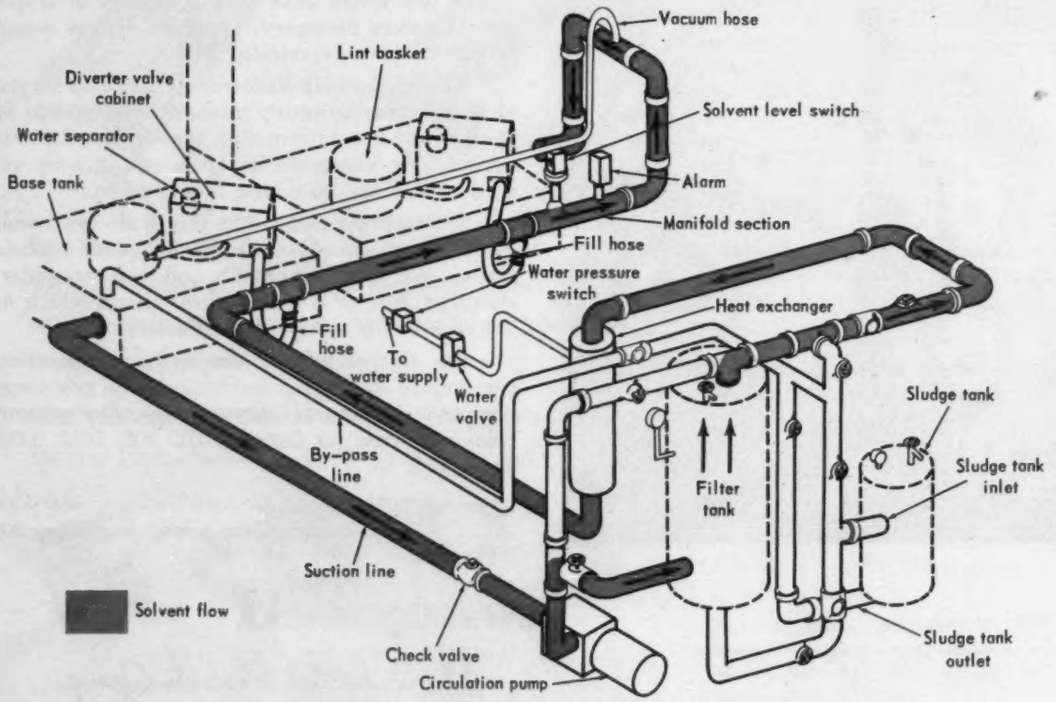
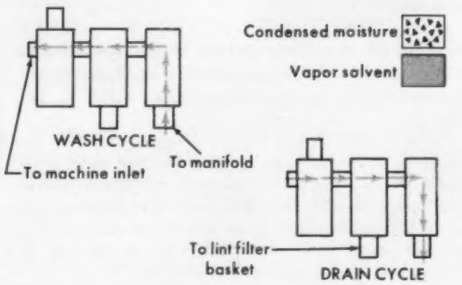
Filtration System Cleans Solvent in Coin-Operated Dry Cleaner

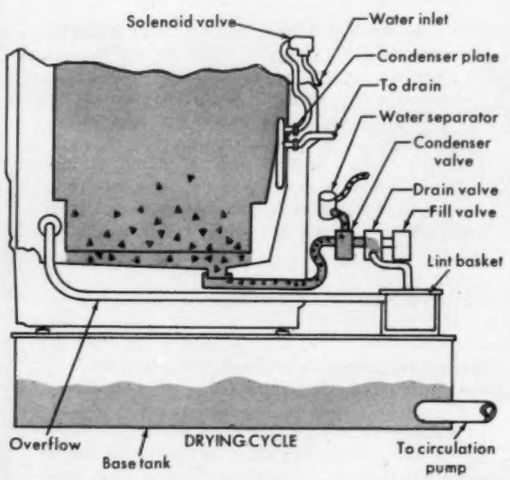
Lars G. Soderholm, Midwest Editor



FILTER TANK has "doughnut"-shaped manifold that discharges solvent into bottom of tank. Top tube sheet holds 48 suspended tubes, each covered with 70 by 80 wire-mesh screen. Filtering agent of diatomaceous earth is built up over mesh screen to catch soil. **SLUDGE TANK** contains steel basket which holds sludge bag. Cover permits removal of sludge bag. When filter tank tubes are beginning to "blind", solvent flow is reversed.







DIVERTER VALVE ASSEMBLY consists of three valves coupled together to provide three different operations by controlling flow of cleaning solvent: (1) In "wash" cycle, fill valve is open, admitting solvent from manifold into machine. Solvent level is maintained by overflow connection which returns solvent to base tank through lint basket. (2) In "drain" cycle, drain valve is open, permitting solvent to flow back into base tank through lint basket. (3) In "drying" cycle, condenser valve is open. Vapor particles impinge on water-cooled condenser plate and drip as solvent and water condensate, to bottom of machine, where they are directed through water separator and solvent returned to base tank.

SOLVENT FLOW PATTERN during filtration. Suction line takes solvent from base tank into circulation pump. It is sent through filter tank for cleaning and through heat exchanger where solvent is cooled to 75-85F. Bypass line returns solvent directly to base tank when backwashing or dropping and agitating filter cake.

A newly introduced dry-cleaning system consists of a group of up to eight coin-operated machines all connected to a common filter. The cleaning solvent is filtered continuously as the solution recirculates during the machine's wash cycle. A solenoid-operated diverter valve provides the three different flow patterns required in the cleaning cycle according to timer demands.

Each dry-cleaning washer is mounted on a storage-base tank which contains 50 gal of solvent when filled to the proper level. During the wash cycle, from 7 to 9 gpm of cleaning fluid are continuously circulated through the washer as the clothing is tumbled by a rotating cylinder.

In order to provide a constant supply of clean solvent to the machines, the used solvent, which flows into the washer base tank, is constantly being removed and filtered. A lint basket is the first step in the filtration system, removing lint from the solvent before it enters the base tank. Next, the solvent is passed through a diatomaceous-earth filter, which has a capacity of 60 gpm. Activated charcoal is added to the solvent to pick up dye colors. A special synthetic silicate is also added to sweeten the system. The silicate removes and controls fatty acids from the soiled garments.

When the diatomaceous earth filter becomes dirty, it can be renewed by bubbling off the old filter cake from the tubes and recoating them with the same material. Finally, both soil and filter agent must be dropped from the filter tank and deposited in a sludge tank for removal from the system. New filter agent is then added to the tubes.

During the drying cycle, the warm air causes solvent vapors to fill the machine. Before these are lost, they are condensed on a water-cooled condenser plate and returned to the base tank. In this manner the solvent can be reused indefinitely through purification and control of solvent loss.

The coin-operated dry cleaners are now in use in several locations in the U. S. Each machine dry cleans about 8 lb of clothing per load. It costs $1.50 and takes about 45 minutes for one entire cycle.

The coin-operated dry cleaner system is made by the Norge Div. of Borg-Warner Corp., Chicago, Ill.

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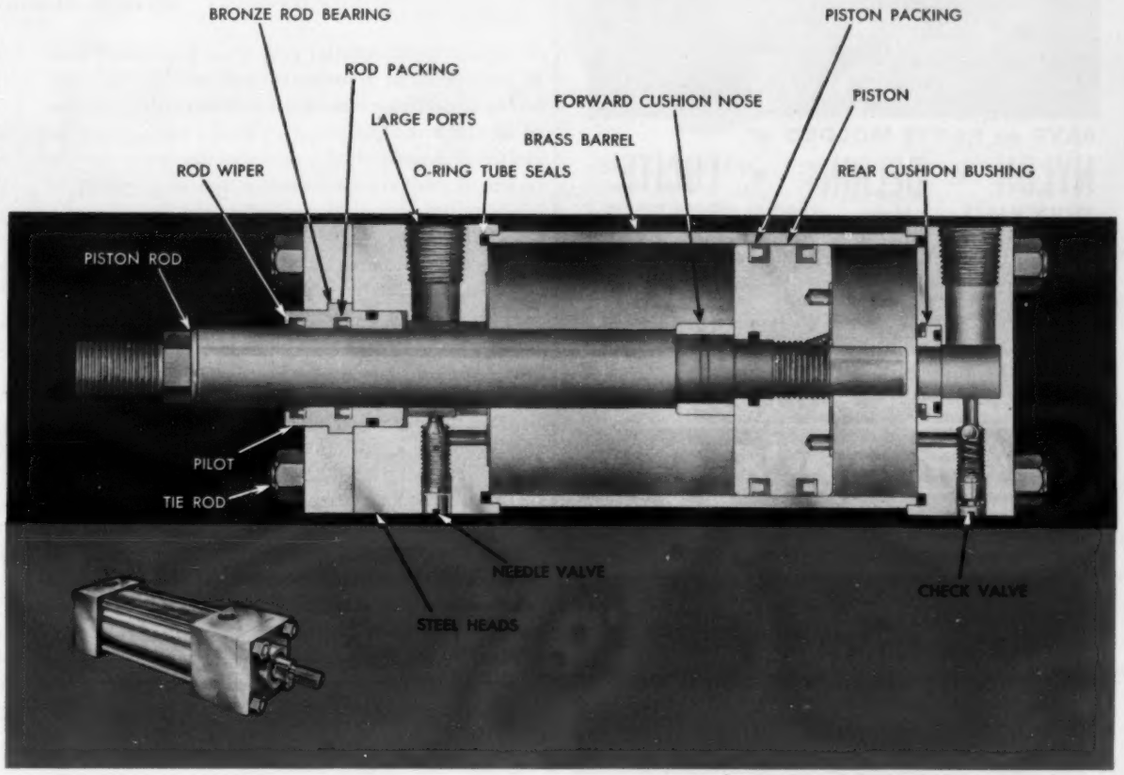

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Epicyclic Differential

Edward W. Schrader, Western Editor

An epicyclic differential gear train positions 75 in-lb loads with an accuracy of 0.15 percent. The differential positioner mechanically sums the position of two motors. The larger ½-hp d-c motor with an electromechanical brake provides the main driving power. A two-phase servomotor acts as a vernier to position the output shaft within the desired accuracy.

The complete system consists of the dual motor actuator, an electronic controller and five remote positioners. The positioners are motor-driven potentiometers. They function to preselect and store the position information. Each individually energized positioner forms a portion of a balanced bridge network. The other half of the network is formed by the feedback potentiometer with the actuator.

Applied error voltages in excess of five percent of full-scale error cause the controller to supply 28v to the d-c motor in the actuator. The d-c motor decreases the error to a point within three percent in advance of the selected position. At this attitude, a position-sensitive relay network de-energizes the d-c motor. The final positioning sequence is accomplished by the servomotor. If the initial error is less than five percent, positioning is accomplished by the servomotor alone.

In the differential positioner, the d-c motor drives the ring gear of the planetary, or epicyclic, gear train. The servomotor drives the sun gear. Three planet gears, contained in a yoke, give the differential rotation, which in turn passes through spur gears to the output shaft. The output shaft is connected to a 10-turn potentiometer in the actuator by means of a simple friction clutch. This clutch permits slip, should the potentiometer reach either of its mechanical stops.

In the application of a Klystron tuning system, the output shaft is quite long. Misalignment between load and actuator is compensated by curving the top of the teeth on the splined output shaft.

The system is used for short-circuiting the plunger positioning as related to a waveguide application of a Klystron tuning system. It is used for remote automatic positioning and indirect frequency selection.

The differential positioner system is a design development of AiResearch Mfg. Co., Div. of The Garrett Corp., Los Angeles, Calif.

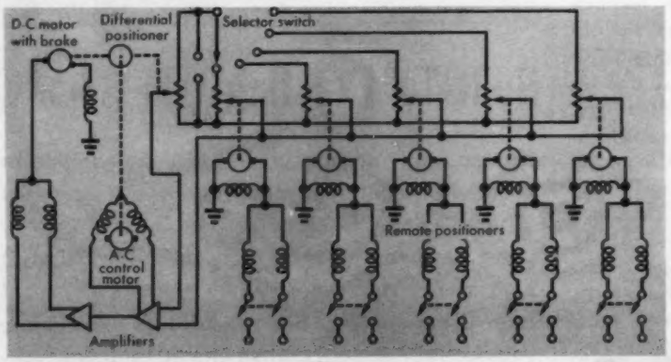
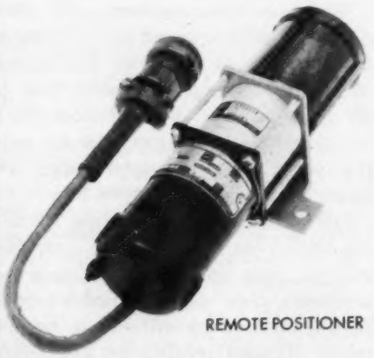
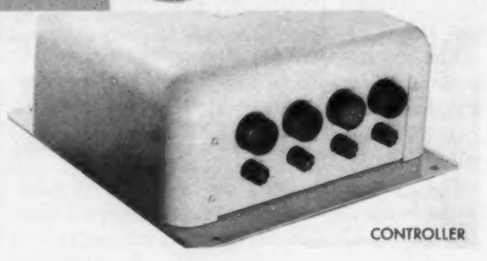


DIAGRAM shows operation of remote-positioning system. Potentiometer within any selected positioner and potentiometer in actuator form balanced bridge network. Bridge unbalances result in d-c error signal and are transformed at controller to give modulated pulse-width output waveform of constant-amplitude. When impressed upon d-c actuator, error is progressively reduced to 0.07 percent of its full-scale value within 10 sec for 100 percent step input. Controller operates on 250 VA at 60 cps, and 750v d-c power. Its output drives d-c motor and a-c servomotor.

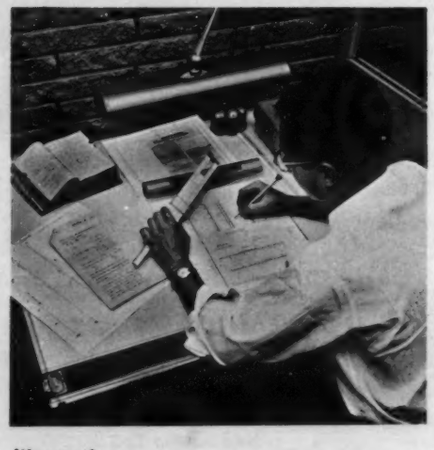


REMOTE POSITIONER



CONTROLLER

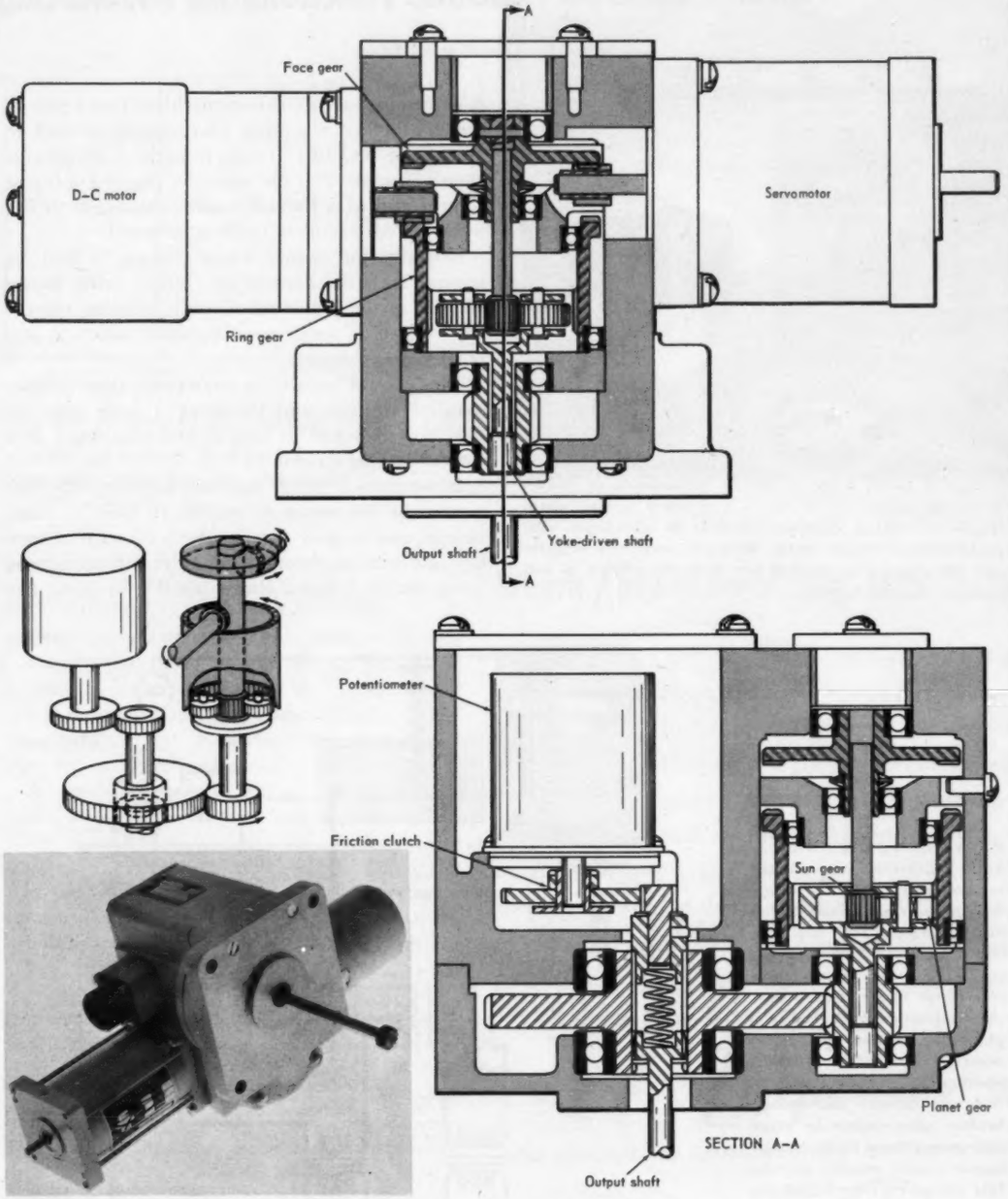
Effective Communication...



Illustrating

DESIGN DATA NEWS

Positions Large Loads



EPICYCLIC DIFFERENTIAL combines rotary position of d-c motor and two-phase servomotor. D-C motor enters error position through ring gear; servomotor enters position through sun gear. Yoke with planet gears rotates to differential position of two inputs.

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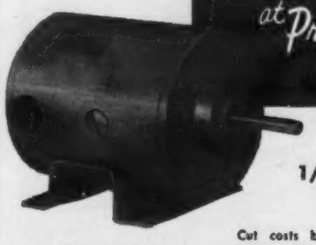

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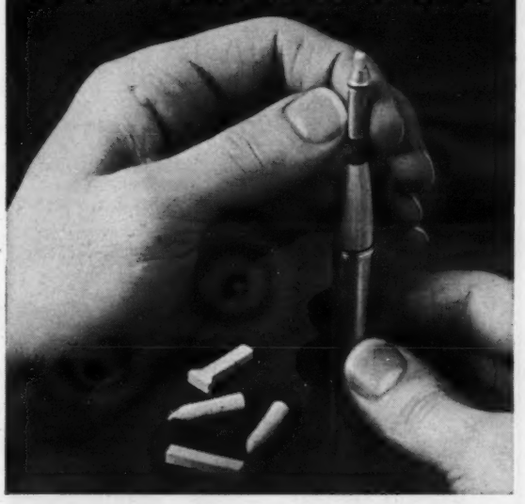

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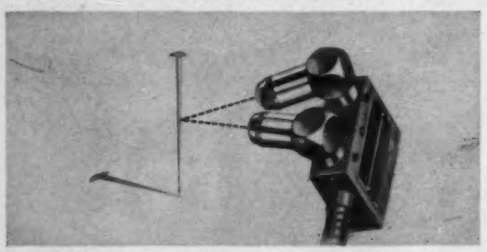

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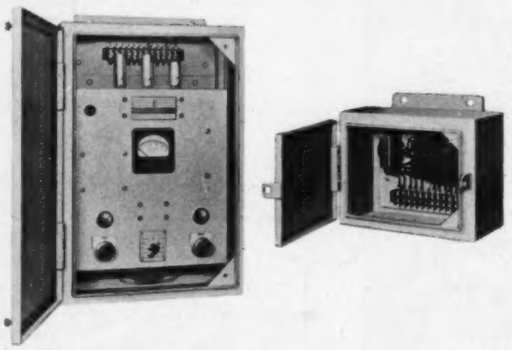
Device Controls Machine Functions by Monitoring

E. J. Stefanides, Central States Editor



A-C MOTOR LOAD-MONITORING DEVICE responds to changes in power which is directly proportional to torque. Relay-type output can be used to stop motor, operate alarm systems or control machine functions in accordance with predetermined torque values. Device is extremely sensitive and will respond to loads of less than one percent of full load for a given motor.

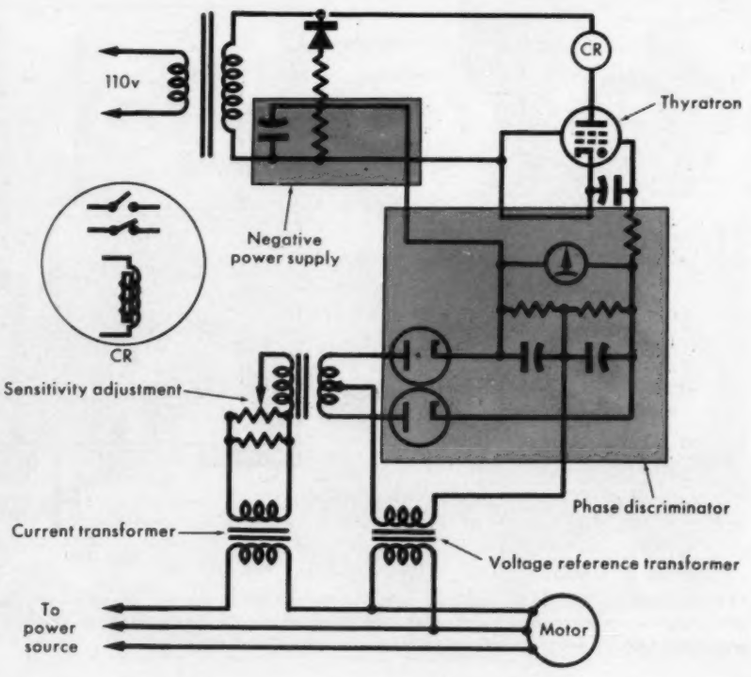
A new control for a-c driven machines uses a pair of diodes arranged in a phase discriminator network to monitor motor loads. Output from the discriminator circuit is applied to the normally negatively biased control grid of a thyratron tube, causing it to fire when a predetermined torque is exceeded.

Basically, the control senses changes in load, by sensing both the amount of current being drawn as well as the phase relationship between current and voltage. It actually senses power, which is proportional to torque.

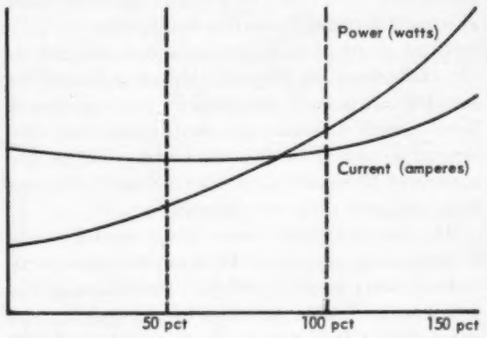
This control (somewhat more costly than current-sensitive controls and requiring a more involved installation) is said to have several advantages over current-sensing systems.

In a-c motors, power increases more rapidly than current as the motor is loaded. In fact, in many motors, current may remain nearly constant or even decrease with increasing load. With a current-measuring device, it is not always possible to detect mo-

PHASE-DISCRIMINATOR NETWORK is connected to three-phase motor by voltage and current transformers. Under highly inductive light load, current input signal is near 90 deg out-of-phase with voltage reference signal. Power factor is near zero (actually around 0.2) and phase-discriminator output is relatively low. When grinding wheel contacts workpiece, load increases, current and voltage become more nearly in phase and output from phase discriminator output exceeds negative bias voltage on control grid, the thyratron conducts. This energizes relay coil CR to operate CR contacts. Approximate response time is 1/20 to 1/10 sec.



A-C Motor Load



CURVES OF POWER AND CURRENT for typical a-c motor show power increases more rapidly than current as motor is loaded.

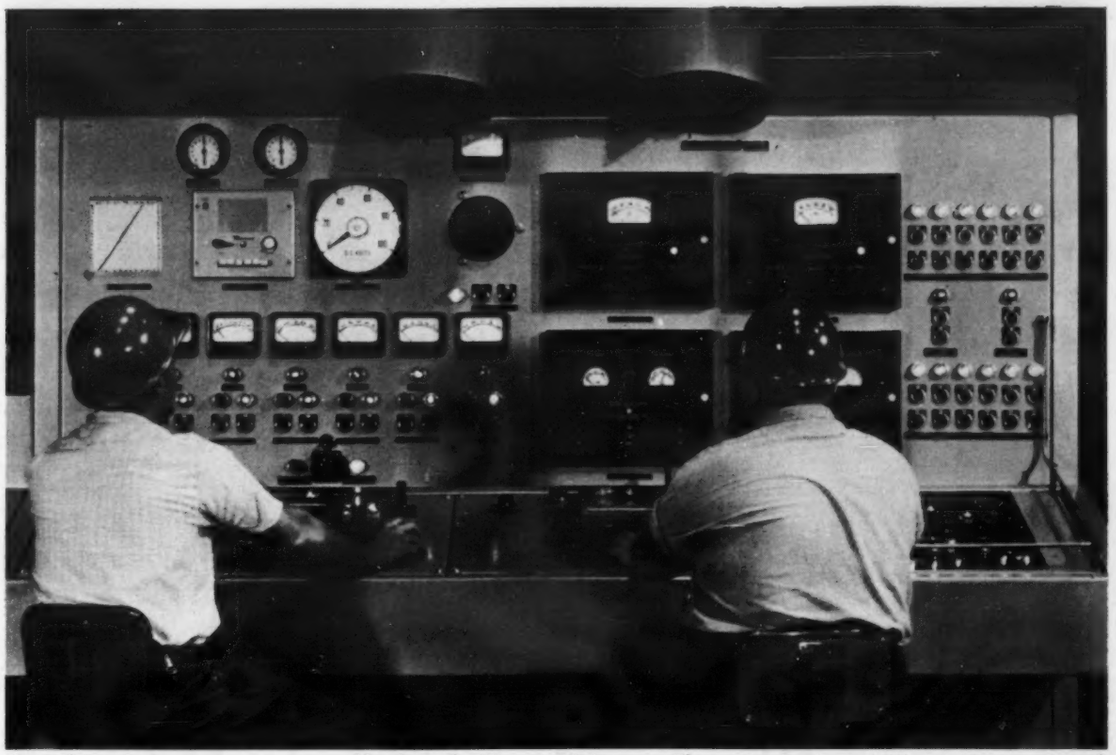
tor load changes unless specific motors are chosen.

Sensing changes in current, voltage and power factor, this sytem will respond to load changes of less than one percent of full load for a given motor and can be used indiscriminately without concern for motor characteristics.

A typical example of an a-c driven machine where this system has been used to control machine functions is a production grinder, which finishes precision parts automatically. The device was used to provide a means of stopping or slowing the relatively high-speed approach of the grinding wheel when contact is made with the workpiece. Limit switches would not suffice for this application since they would have to be set conservatively and could not make allowances for wear. Therefore, their use would result in unnecessary approach time.

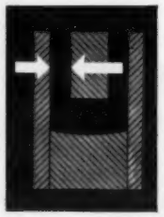
By monitoring motor load, this control device stops the approach feed at the desired point when the wheel touches the workpiece. Approach time is held to a minimum and the machine is capable of its maximum productivity.

This control has been designated the Torque-Trol by the Clark Controller Co., Cleveland, Ohio, that is marketing the device.



Control panel of a Carpenter consumable electrode (Consumet) furnace. Electronic circuits maintain positive arc control and precise electrode movement to assure the ultimate in refining.

Where *Carpenter's* "big inch" makes a mile of difference in alloy quality



The "big inch" in Carpenter's consumable electrode (Consumet®) furnace is the extra space between the consumable electrode and the mold wall. (Conventional furnaces of this type are almost ⅓ smaller at this vital point.) The "big inch" in Carpenter's furnace provides more exhaust space to carry off harmful gases. It also gives Carpenter technicians more precise vacuum control during the arc strike as well as during the entire melting process. As a result, you get cleaner, more uniform alloys from core to surface. Segregation and variation in grain size are minimized . . . to assure you consistent, predictable performance from your vacuum melted alloys. The "big inch" is only one of many exclusive Carpenter quality controls in consumable electrode, MEL-TROL® and vacuum-induction-melted (VacuMeltrol®) specialty steels. Ask your Carpenter representative for the full story behind these alloys and how they benefit you.

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Carpenter Steel of New England, Inc., Bridgeport, Conn.

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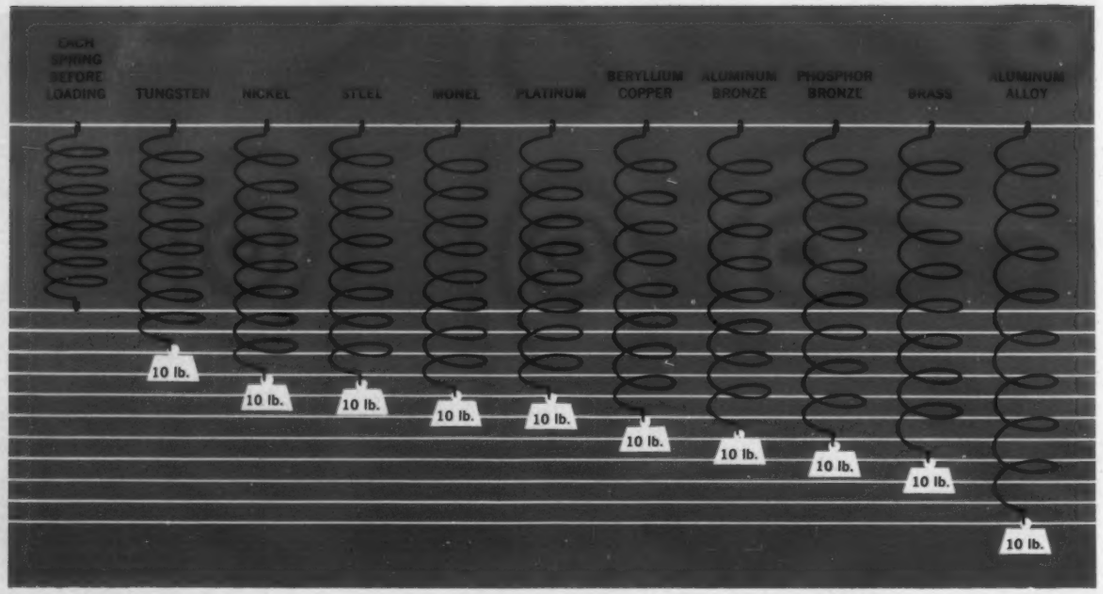

How much deflection do you want in a spring ?

The wide range of stiffness characteristics available in different materials offer unusual opportunity to solve spring deflection problems. How wide is shown in the chart above. The tension springs are all of identical dimensions but of different materials and indicate the relative deflection obtained from applying the same load (assuming the stresses are within safe limits). This basic principle is often overlooked in the approach to spring selection not only of extension springs but other types: flat, torsion, etc. Because our daily work includes such a wide range of spring usage, we are in a position to help you in the early stages of spring consideration, both in material selection and production short cuts. A handy pamphlet to have at your elbow is our "Metal Selector." Write for your copy.

5806

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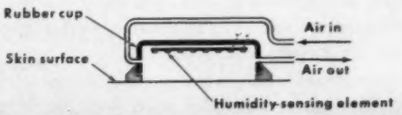
Air Flow Rate Servo

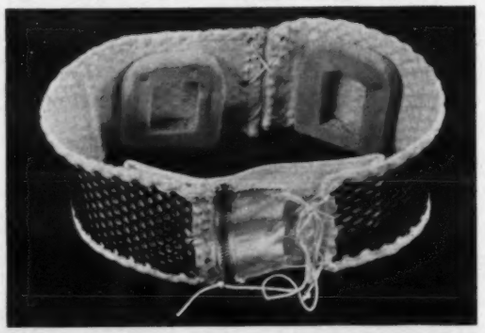
M. Neuburger, Correspondent in Canada

Flow rate of a warm, dry air stream through a sensor cell is regulated by a servo-controlled valve to maintain constant relative humidity in the cell. Settings of a precision potentiometer coupled to the valve shaft are recorded and/or indicated on suitable instruments. Designed for investigation of human stress as shown by perspiration rate, this system is said to overcome masking effects encountered when skin electrodes are used, resulting from residues slow to evaporate.

The resistance-type sensor cell is carried inside a rubber cup placed on the skin; two ports facilitate constant flushing with air. Unbalance of the Wheatstone bridge attached to the sensing element results in a signal which is amplified and applied to the valve-setting servomotor. Air flow is then increased or decreased until the sensing element has been restored to its normal condition. Degree of valve opening is thus directly proportional to perspiration rate of skin covered by rubber cup.

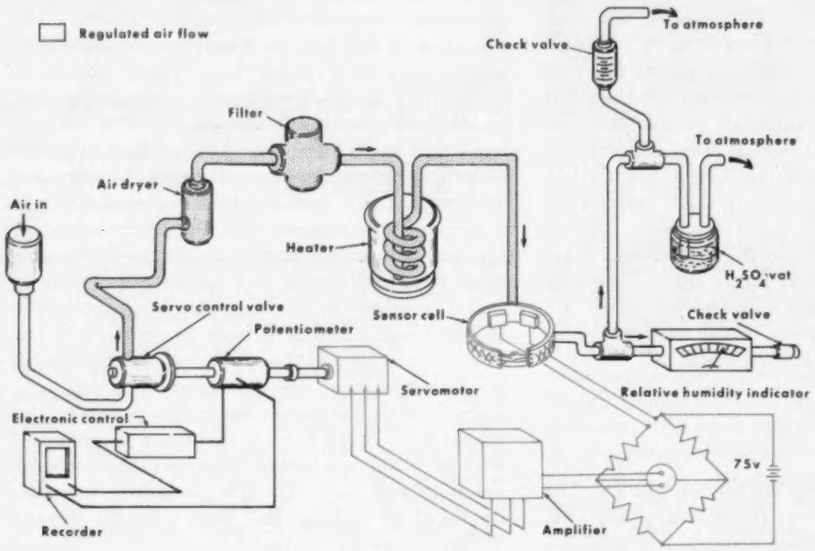
Importance is attached to this development as an aid in monitoring the level of consciousness of plane and rocket pilots. It is the result of work by A. C. Custance, Ph.D., of the Human Engineering Group, D.R.C.I., Defense Research Board, Ottawa, Canada.





SENSING ELEMENT held in rubber cup comprises two meshed, etched grids on dielectric epoxy-resin fiber glass sheet. Grids are gold-plated to minimize oxidation and polarization. In present development state, best sensitivity and response rate are obtained by dipping element in polyvinyl alcohol containing lithium chloride.

Quickens Humidity Change Response

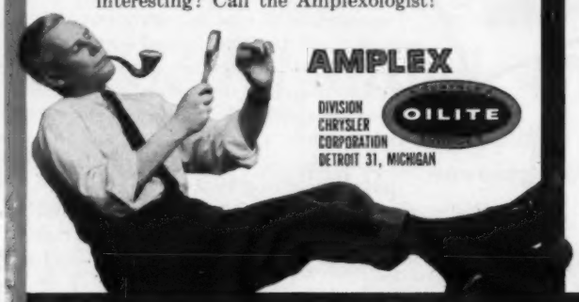


SYSTEM LAYOUT is simple. Air supply from compressor or bottle is regulated by valve, then dried, filtered and heated to constant conditions. Flow through relatively small sensor cup enables air to restore normal humidity in cup quickly, giving system fast response. Exhaust air can be diverted for relative humidity measurement, weighing of perspiration contents or flow rate check.

THE AMPLEXOLOGIST

powders a price tag

Originally, the part shown (double V pulley) was designed to be machined from steel. But before it was incorporated into a new model the Amplexologist was called in. Result: the part was designed for powder metal and is now produced as a finished precision part which requires no machining. Estimated saving 82%. Sound interesting? Call the Amplexologist!



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AERONAUTICAL AND ASTRONAUTICAL ENGINEERS, and anyone engaged in the design or fabrication of airplanes and missiles, will find MODERN FLIGHT DYNAMICS, by W. Richard Kolk, a valuable text and reference guide. The 288-page volume bridges the gap between airplanes and rockets with particular emphasis on dynamic motion and stability of that motion. Two introductory sections, Cosines and Eulerian Angels, are used as tools with which the dynamics of flight vehicles are analyzed. For clarity and ease of continuity, analyses whose results are essential to the subject matter are included in the appendices rather than in the text itself. Vector analysis, calculus and mechanics are the only prerequisites. Price of the book is $10.00. Prentice-Hall, Inc., Englewood Cliffs, N. J.

MAGNETIC TAPE INSTRUMENTATION. The recording of electrical signals in analog form on magnetic tape has presented a completely new tool to the scientist and engineer. It represents an extremely convenient electrical memory requiring no processing between recording and reproduction. The literature in the field of magnetic tape instrumentation is scattered widely in technical periodicals and knowledge of it is quite difficult to locate. This guide to data recording and reproduction by magnetic tape shows the reader how to use equipment and apply techniques with maximum efficiency and minimum cost. A technical background and at least a speaking acquaintance with electronic technology on the part of the reader are assumed. Ranging from basic techniques used in data recording to major applications of magnetic tape equipment, this 272-page, illustrated book presents up-to-date know-how needed by those who use such equipment in instrumentation and data acquisition and processing systems. Gomer L. Davies has presented this material in a broad scope so that everyone associated with magnetic tape instrumentation—designer, manufacturer and user—will find something of value. Published by McGraw-Hill Book Co., 327 W. 41st St., New York 36, N. Y.; $8.50.

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STRICTLY BIRDSMANSHIP or: How to Lay the Egg That Kills the Golden Goose is currently providing amusement and provocative thought at all levels in the government and business world. Written by Bernard S. Benson, this cartoon book is a pungent diagnosis of some of the ills that plague industry in its efforts to "keep America on top". This book has already been received with enthusiasm by government and military leaders as well as by industry and the man on the street. Published by Benson-Lehner Corp., 1860 Franklin St., Santa Monica, Calif.; 80 pages; $3.

CREATIVE ENGINEERING DESIGN. "The solution of 'scientific' problems is not straightforward and precise but requires the use of the greatest ingenuity. Each engineer should realize that it is possible to *develop* creative problem-solving ability." This very comprehensive book is an excellent starter for those who want to develop latent creativity and decision-making ability. The problem-solving phases of Recognition, Definition, Preparation, Analysis, Synthesis, Evaluation and Presentation form the individual chapters. The reader is encouraged to consider design as a flexible, decision-making activity rather than a blind use of rigid methods and equations. Traits of the creative engineer and the creative supervisor are specifically detailed, as well as the current group idea-creating techniques. Many sample problems follow each chapter. In addition, Design Work Sheets and Evaluation-Check Lists are included. This book should be "required reading" for those engineers who want to "get off the beaten path" and onto the road of thinking imaginatively and designing creatively. By Harold R. Buhl; Iowa State University Press, Press Bldg., Ames, Iowa; 195 pages; $3.95.

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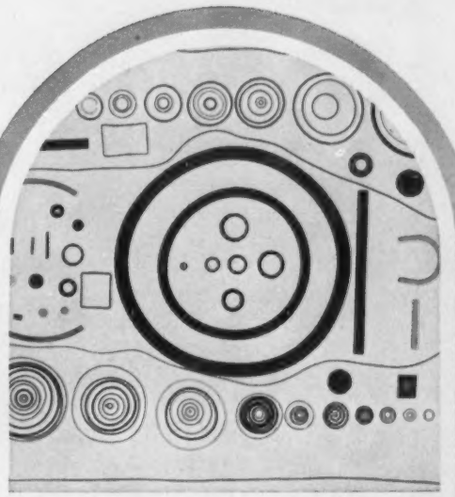

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Oscilloscope photos show capabilities of Taylor Liquid Devices from the standard line

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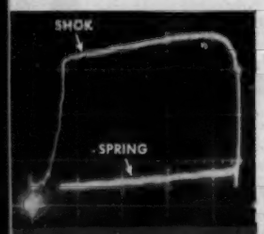
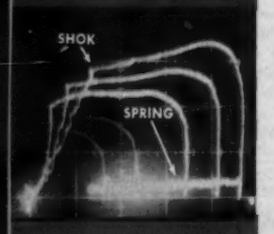
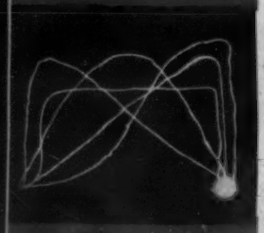


SPRING PLUS SHOK IN 1 UNIT
Used on aircraft arresting gear

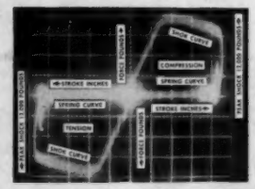


MINIMUM IMPACT OR SHOK FOR ANY ENERGY INPUT CONDITION
Used on carrier applications



ANY SHAPE ENERGY ABSORPTION CURVE
Used on electric circuit breakers

OSCILLOSCOPE photograph of the Taylor Tension-Compression Spring Shok shows energy absorbed under shock curve up to 80% of square card and spring capabilities to reposition fighter plane arresting hook shown at right. This unit provided 27.5 pounds weight reduction in 1/5th the space. Taylor Liquid Spring Shoks are designed to absorb and store energy in both directions. Double acting piston system uses same liquid to provide identical or different energy in tension and/or compression. Any desired shok or spring curve is available to meet exact requirements.



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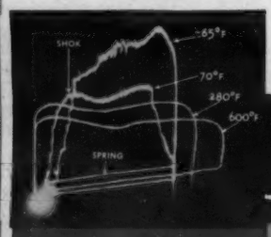

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BOOKS

INTERNATIONAL AUTO PARADE: 1961. A survey of the world's motor cars of this year. The fourth edition contains more than 380 pictures and descriptions of automobiles, including sports cars and some racing cars. Important technical data are given for each model.

This is truly an international work, with the text presented in English, German, French and Italian (the book is edited in Switzerland, printed in Germany and published in the U. S.).

A very exciting report from the "Grossen Preis" of Germany and the Automobile Constructors' championship is given in the opening pages. Previous editions began a series of articles on automobile design entitled "Evolution of the Engine" and "Internal-Combustion Engines". A third article, "The Transmission", is included in this edition. Some interesting test reports on the more outstanding models are given by independent experts.

Good entertainment and a pleasant trip through the international automobile world of 1961 are found in "Auto Parade: 1961". Edited by Arthur Logoz, et al; Chilton Co., Book Div., 56th & Chestnut Sts., Philadelphia 39, Pa.; 338 pages; $10.

Circle 193 for Reader Service

ENGINEERING MATERIALS SCIENCE. Presented from an engineering point of view, this book offers comprehensive coverage and a valuable modern view of materials science. Intent of the book is to prepare the engineering student and to help the working engineer make the most effective use of materials available. Part I, of three parts, gives General Principles, including structure of solid materials. Part II discusses Mechanical Behavior, including ordinary static loads, combined stresses and notch effect, dynamic loads, high and low temperatures, fatigue and hardness. Physical Behavior is the subject of Part III and covers the physical basis for the common electrical, magnetic and thermal properties. The general pattern of the book is to discuss the general, then the specialized, aspects of materials and their applications. By Cedric W. Richards; Wadsworth Publishing Co., Belmont, Calif.; 546 pages.

AGRICULTURAL ENGINEERS' HANDBOOK. As the title implies, this volume is a reference work on a variety of engineering subjects related to agriculture. Although of the most value to the agricultural engineer, the handbook may be useful to mechanical engineers in terms of farm equipment and machinery, and to the civil engineer in terms of irrigation and water control. In addition to the sections on Crop-Production Equipment and Soil and Water Conservation, a third section covers Farmstead Structures and Equipment. By C. B. Richey, et al; McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y.; 880 pages; $19.50.

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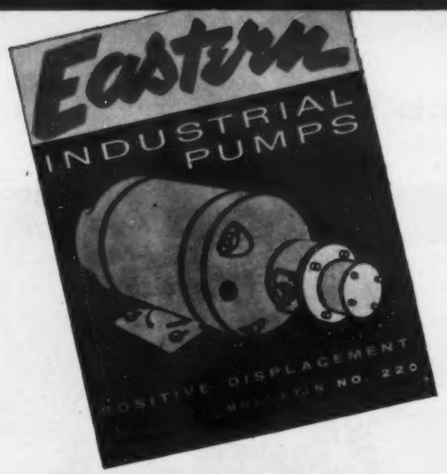

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If you have a performance requirement for pumps which can deliver a pulsation-free flow of non-lubricating liquids at pressures up to 200 psi on the gear type or rates up to 6 gallons per minute on the vane type, pick a winner from the big Eastern line.

For small volumes against relatively high pressures, the Eastern GW series gear pumps are a natural. In each pump, oversized bearings of impregnated graphite support a drive gear of stainless steel and an idler of special bronze material. These self-priming units require no lubrication and cannot contaminate the liquid being pumped.

For volumes from 1.5 to 6 gpm and pressures to 60 psi, you can't beat Eastern VW series vane pumps. These highly efficient units are designed around a cam-shaped pumping chamber assuring pulsation-free liquid flow. Vanes are held in positive contact with the pumping chamber at all times — and their positioning is independent of hydraulic pressure or centrifugal force. Composition carbon graphite bearings and vanes require no lubrication beyond that of the liquid being pumped.

All Eastern positive displacement pumps are close-coupled with motor or can be furnished less electric motor with belt stand for belt or coupling drive.

Don't make your points the hard way — play safe and write for Eastern's new Bulletin 220 on positive displacement pumps.

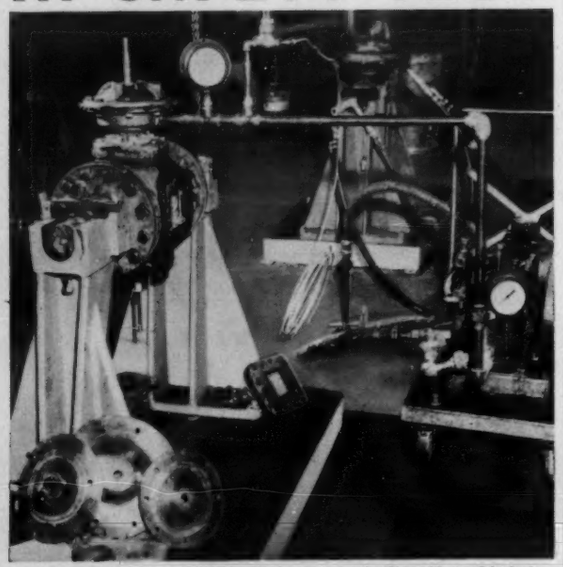
Other Eastern products:

- ***hydraulic motors***
- ***gear pumps***
- ***centrifugal pumps***
- ***aircraft pumps***

EASTERN INDUSTRIES ★ PUMP DIVISION ★

EASTERN INDUSTRIES INCORPORATED
Hamden, Connecticut

DIAPHRAGM OF REEVECOTE WITHSTANDS 23,520 LB. THRUST IN SAFETY TEST



Safety tests for gas regulator diaphragms are run by Reynolds on this device fed by a hydraulic pump. Here, on an effective area of 24 sq. in., a Reevecote synthetic diaphragm safely absorbed a total thrust of 23,520 lbs.

The Reynolds Gas Regulator Co., of Anderson, Ind., takes unusual safety precautions to check the tensile strength of diaphragms in their gas regulators.

Some of their diaphragms must absorb sudden surges in pressure—up to 1000 psi. That's why Reynolds runs special safety tests on the diaphragms.

The results of these tests prove the outstanding superiority of diaphragms made of Reevecote.

In a recent test at Reynolds, Reevecote 7270, 0.093" gauge a Buna-N coated nylon, successfully withstood 980 psi on an effective diameter of 24 sq. in.—or a total thrust of 23,520 pounds.

Reevecote diaphragms are flexible and sensitive, yet tough enough to stand up safely under severe extremes of pressure.

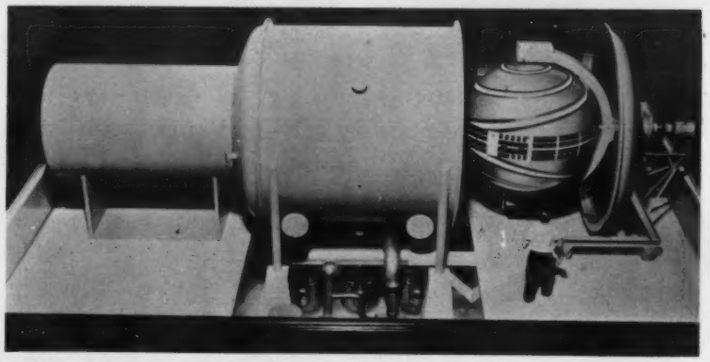
If your design calls for the use of diaphragms, or coated fabrics—choose from the most complete source of coated fabrics for industry—REEVECOTE.

REEVES VULCAN

Reeves Brothers, Inc., Vulcan Rubber Products Division
1071 Avenue of the Americas · New York 18, New York

Circle 195 on Reader-Service Card for more information

SCANNING PRESS RELEASES



SATELLITE, shown mounted on simulator door, will tumble through space in two directions, 30 rpm on one axis and 200 rpm on the other.

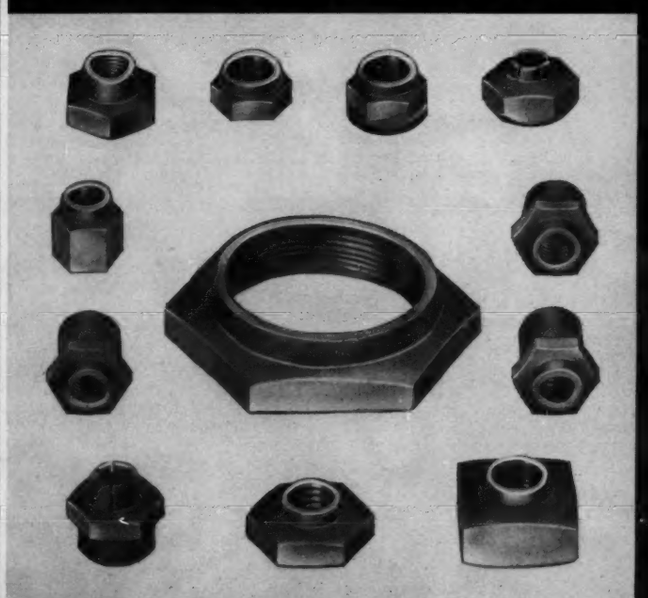
• **ORBITAL SIMULATOR,** capable of testing an eight-ft satellite spinning in two directions, will provide space thermal radiation levels and solar spectral radiation of variable flux. A special heat sink "black wall", refrigerated to —320F with liquid nitrogen, will absorb radiation and prevent bounce-back to the test object.

The chamber, a stainless-steel cylinder, will be 12 ft in dia and 11 ft long. Pressure will be reduced to 1 x 10^{-7} mm Hg, or 1,100,000 ft. The cryogenic system will dissipate a maximum heat load of 700,000 Btu per hr.

Arms mounted on the simulator's door will hold a specimen up to 1000 lb in weight, rotating at 30 rpm on the primary axis and 200 rpm on a secondary axis. Both axes will accelerate at the rate of one rpm per sec.

Tenney Engineering, Inc., Union, N. J., is prime contractor for the orbital simulator which will be installed at a new test center being built by Chance Vought Corp.

SPECIAL LOCKNUTS . . . *that solved fastening problems*



As the largest specialized nut manufacturer in the world we are constantly developing new methods and products for this phase of assembly in industry . . . in the field of locknuts we have made spectacular progress. Besides standardized hexagon "Conelok," "Huglock" and "Marsden," sizes #10—3" of ferrous and non-ferrous materials, we provide many special application nuts, upon a basis of these designs . . . a few of which are here shown . . . Our sales and engineering departments are available to help you solve your fastening problems . . . Send for 12-page condensus-catalog, it includes complete specifications of our entire product, as well as engineering data. We also have an one hundred and forty four page catalog where more comprehensive information is required.

Manufacturers of Standard and Special ferrous and non-ferrous Hexagon, Square and "12 Pointer" nuts . . . "Conelok," "Huglock" and "Marsden" locknuts.

NATIONAL MACHINE PRODUCTS COMPANY

an sps company 44250 UTICA ROAD UTICA, MICHIGAN

Circle 196 on Reader-Service Card for more information

LOOK BEFORE YOU LEAP..

and you will SPECIFY THOMAS FLEXIBLE COUPLINGS

It is just plain common sense to "Look before you leap" when selecting a flexible coupling.

An inferior coupling causes wear and damage to your machines — resulting in high maintenance costs and costly shut-downs.

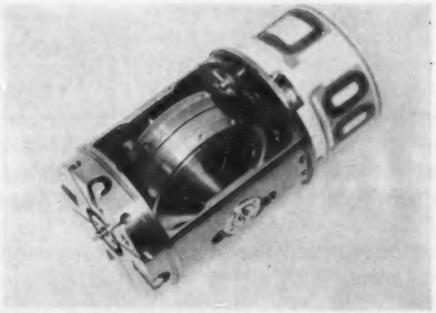
Troublesome maintenance problems are eliminated when you specify Thomas "All-Metal" Flexible Couplings to protect your equipment and extend the life of your machines.

NO MAINTENANCE
NO LUBRICATION
NO WEARING PARTS
NO BACKLASH

Write for Our New Engineering Catalog 60

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

Circle 197 on Reader-Service Card



GYRO WHEEL is unitized with bearing assembly. Torquer-pickoff is at right.

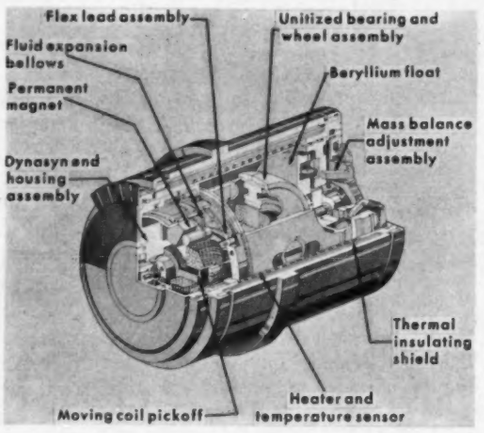
• **MINIATURE GYROSCOPE** has been developed by Sperry Gyroscope Co. for use in guided missiles and space vehicles. If employed on a mission to the moon, the gyro would enable the vehicle to land within one mile of the predicted site.

Weighing less than 1 lb and under 3 inches in length, the gyro has shown drift sensitivity to be less than 0.005 deg per hour/g^2 under vibration tests involving gravity forces multiplied up to 20 times.

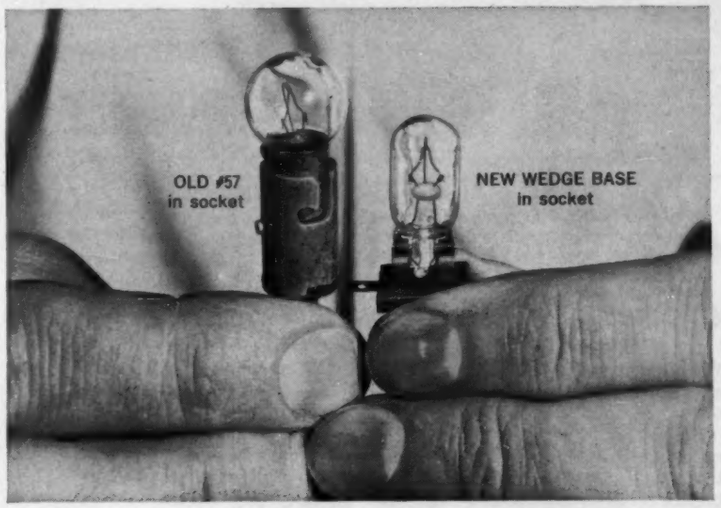
High life expectancy has been designed into the gyro through the development and application of new, low-wear ball bearing steels and lubrication practices. The wheel is unitized to the bearing assembly which yields a high degree of geometry control previously unattainable without a complex final assembly operation.

A ceramic torquer-pickoff, combining both torque and signal generators in a single package, improves accuracy and gives a more dimensionally stable geometric form than the separate elements formerly used.

A special nonfreezing flotation fluid allows safe storage from —85F to 185F and operation from temperatures as low as —65F. Thermal averaging layers in the gyro's outer wall provide freedom from temperature fluctuations.



NEW G-E "WEDGE BASE" LAMP SAVES SPACE, SAVES MONEY, SAVES TIME, SAVES MANPOWER



The new "Wedge Base", all-glass, incandescent indicator lamp is an exclusive G-E development designed to replace the old #57 and other similar bayonet-based lamps. It's available in 6.3 and 12 volts. See below.

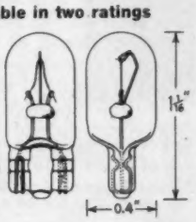
The Wedge Base saves space because, with its holder, it is considerably smaller than the old #57. It saves money because the holder and total installation costs are less. It saves time because the holder is easier to install and the lamp can be seated with just a push. And it saves manpower because installation can be automated and holders can be molded into plastic circuits. The G-E Wedge Base lamp can withstand ambient temperatures up to 600°F because it has no basing cement.

A major automobile manufacturer is already using G-E Wedge Base lamps; they're available in mass quantities. For more information write: General Electric Co., Miniature Lamp Department M-12, Nela Park, Cleveland 12, Ohio.

The Wedge Base is available in two ratings

G.E. Lamp No.	158	159
Circuit Volts	12	6.3
Amperes	0.24	0.15
Design Volts	14	6.3
Rated Av. Life at design volts	500 Hrs.	*
Filament	C-2V.	C-2R
L.C.L.	½"	½"
Bulb	T-3¼	T-3¼
Base Type	Wedge	Wedge
Candlepower	2	.35

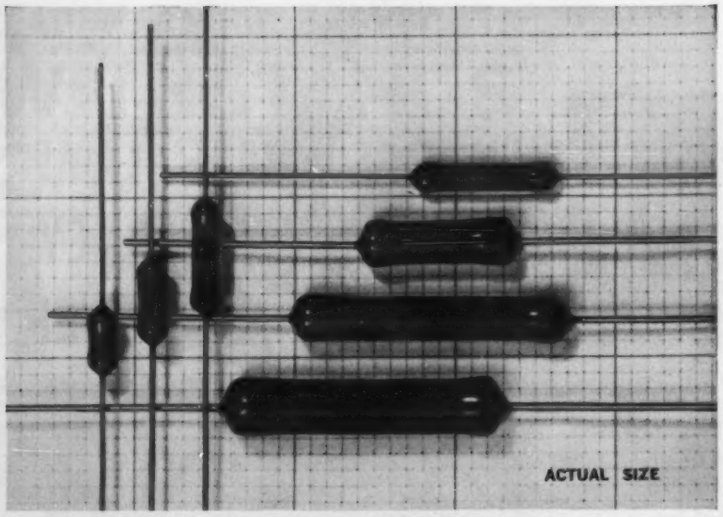
*In excess of 5000 hrs. at 6.6 volts



Progress Is Our Most Important Product

GENERAL ELECTRIC

Circle 198 on Reader-Service Card for more information



THESE "WIRE-WOUNDS" ARE CIRCUIT SHRINKERS . . . . . *newly*

expanded line lets AXIOHM® power resistors go into smaller circuits!

Ward Leonard AXIOHM power resistors are now available in *seven* sizes—down to 2 watts, up to 12.5.

They're ideal for miniaturization in printed-circuits, industrial instrumentation and automation circuitry. But they're recommended for *any* electrical or electronic application where the highest stability and maximum overload capacity are required.

The seven AXIOHM sizes come in a complete range of resistance values (see table) from 0.1 to as high as 75,000 ohms. Naturally, they feature the qualities Ward Leonard has made famous in power resistors:

Vitrohm vitreous enamel; Ward Leonard's specially made ceramic core; specially selected and matched resistance wire; and strong, permanent, low-resistance, spot-welded, lead-to-end-cap junctions. o-9

SIZES AND RATINGS

Rating (in watts)	Type	Resistances (ohms)		Dimensions (inches)	
		Min.	Max.	Length*	Diam.
2	2X	0.1	5,000	⅜	3/16
3	3X	0.1	10,000	½	3/16
4	4X	0.1	15,000	11/16	3/16
5	5XM	0.1	20,000	15/16	3/16
7	7X	0.1	25,000	1	5/16
10	10XM	0.1	50,000	1¾	5/16
12.5	12.5X	0.1	75,000	1¾	⅜

*Less leads.

Get complete details in Supplement C to Catalog 15. Write for your copy and a list of stocking distributors today. Ward Leonard Electric Co., 26 South Street, Mount Vernon, New York. (In Canada: Ward Leonard of Canada, Ltd., Toronto.)

RESULT-ENGINEERED CONTROLS SINCE 1892

WARD LEONARD ELECTRIC CO. MOUNT VERNON NEW YORK

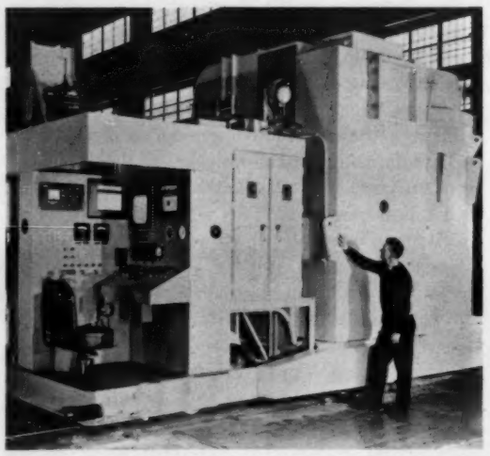
RESISTORS • RHEOSTATS • RELAYS • CONTROLS • DIMMERS

Circle 199 on Reader-Service Card for more information

RELEASES

• **$700,000 VEHICLE** for loading atomic fuels and removing highly radioactive atomic wastes from the Enrico Fermi Atomic Power Reactor has been built by Baldwin-Lima-Hamilton Corp. Called a transfer cask car, the massive, highly complex vehicle is one of 12 major components of the plant.

The self-propelled cask car, operating over a special 100-ft railroad track, provides means for replacing spent fuel elements in the reactor with fresh fuel elements and for transporting the fuel assemblies safely to and from storage areas outside the reactor building. A heat-transfer system is incorporated in the cask car design for preheating fresh fuel elements before they are charged into



the reactor and for dissipating radiation heat from spent elements.

Though only 22 ft long by 10 ft wide by 13 ft high, the car weighs 200 tons because of the heavy radiation shielding of lead and spent uranium.

The cask car rides on two traveling crane carriages with five forward and reverse speeds. Major sections include a large, shielded cylinder, where handling and carrying of the fuel elements is accomplished, the heat transfer system and a control cab, accommodating the operator and a console grouping of all instruments and controls. Eleven fresh fuel assemblies at a time are accommodated in the cask.

Special, helium-leak-tight closures and seals for all cask openings were required. As part of this problem it was necessary to design and install a special, 10-inch dia ball valve which is molecule-tight (totally leakproof). The ball for this valve is of depleted uranium, ground to an eight-microinch finish.

IT'S NO SECRET-

If It's Made of Wire . . . USP Can Make It Best!

USP design engineers can add sales appeal to your product by providing strong, attractive welded wire components in any desired shape or size...in the finish you prefer. USP offers the finest, most modern wire fabrication and in-plant finishing facilities to assure you the utmost in production economy and on-time delivery. USP quality control is backed by more than 60 years of wire fabrication-finishing experience.

Why not start today—see how easily you can profit through the use of Union Steel's modern techniques.

YOU ARE INVITED—to investigate the advantages of Union Steel's wire product design and development service, without obligation. A card, letter or call will bring immediate action.

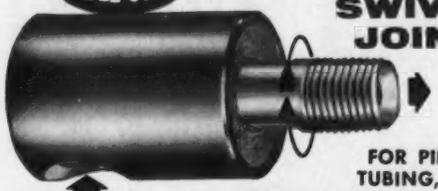
UNION STEEL PRODUCTS CO.
330 N. Huron Street
Albion, Michigan

Circle 200 on Reader-Service Card

Here's How to Make Hose Work Better, Last Longer!

BARCO

LOW COST, BALL BEARING **SWIVEL JOINT**



FOR PIPING, TUBING, HOSE

For Hydraulic or Pneumatic Service

Here is the *new* BARCO SINGLE PLANE SWIVEL JOINT that swivels in one plane only. Ideal for use as a *swivel connector:*

- **Key to Better Engineering!** Small, light, inexpensive. Very low torque under pressure. Neat, space-saving installations. Easy to position lines accurately.
- **Many Uses:** (1) To make piping or tubing movable, flexible! (2) As swivel connectors on hose to eliminate torsional working stresses and long radius bends. Longer hose life! Shorter lengths required!
- **Sealed, Unitized Construction.** Built with ball-bearings. O-ring seal. Choice of styles; sizes ¼", ⅜", ½", ¾". For service to 2,000 psi, −20° to 225°F. Other types available for higher ratings. *Ask for Catalog Sheet 406.*

BARCO MANUFACTURING COMPANY

519E Hough Street • Barrington, Illinois

Circle 201 on Reader-Service Card for more information

It fits in

—to a wide range of in-plant and original equipment needs

New MARSH "Service Gauge"

A remarkable series of 2½" gauges brings you quality, accuracy and stamina —along with REAL economy!

Ranges: 15-30-60-100-160-200-300-600-1000 lbs. and 30" vacuum

¼" bottom connection.

All have strong 2½" bonderized case and brass screwed ring with bevelled glass. All have new Marsh "Read-easy" dial. All are *standard* with Marsh "Recalibrator." Every gauge is guaranteed accurate within 1% of dial reading.

Two types cover wide range of needs: Type 11 has silver-brazed copper alloy bourdon tube and bronze-bushed movement. Type 11S has 316 stainless steel bourdon tube with 303 stainless tip and socket; stainless steel and monel movement.

Ask For New Bulletin

MARSH INSTRUMENT COMPANY Dept. 38, Skokie, Ill.

Division of Colorado Oil and Gas Corporation

Marsh Instrument & Valve Co., (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Canada • Houston Branch Plant, 1121 Rothwell St., Sect. 15, Houston, Texas • Eastern Seaboard Warehouse: Marsh Instrument Company, 1209 Anderson Ave., Fort Lee, N.J.

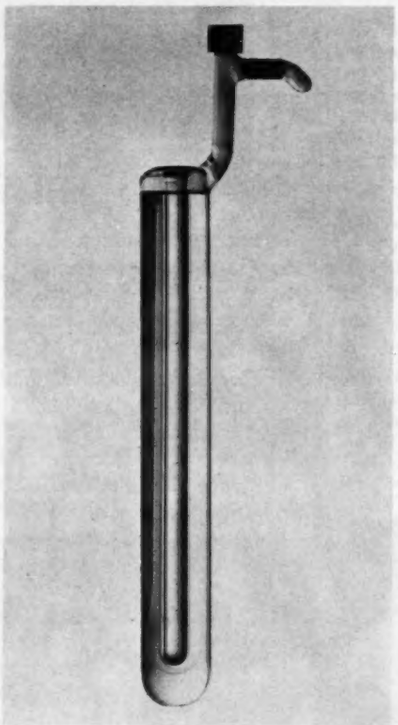
GAUGES • THERMOMETERS • VALVES

Circle 202 on Reader-Service Card for more information

• **TEXT** of the International Temperature Scale of 1948 has been revised by the National Bureau of Standards. The new text was adopted at the October 1960 meeting of the General Conference on Weights and Measures, at which time the name of the scale was changed to the International Practical Temperature Scale of 1948.

No values of temperature on the scale have been changed, but the triple point of water (0.01C) has replaced the ice point as one of the defining fixed points of the scale. This action in no way changes the scale, however, since zero C is defined as that temperature 0.01C below the triple point of water.

Triple point cells have been in use at the Bureau for many years. Pure water is sealed in an air-free glass container, having an axial reentrant well for the thermometer. A mantle of ice is created around the well by freezing from within, and then a small amount of this mantle is remelted to produce a water-ice interface close to the well. After a stabilizing period of a day or more, a cell kept in an ice bath is capable of maintaining a temperature constant to within 0.0001C for several months. This method is more reproducible than the procedure for realizing the ice point, which is accomplished by mixing shaved ice with air-saturated water in a Dewar flask.



TRIPLE POINT CELL used to achieve fixed point (0.01C) on International Practical Temperature Scale. Mantle of ice can be seen surrounding re-entry well.

PLASTIC EXTRUSIONS... ANY SHAPE OR SIZE

ACE is one of America's leading mass producers of plastic extrusions and all types of precision parts. Any shape, form or color. Any type of plastic. Small runs or large runs. Huge stocks for immediate delivery. Quick, low-cost service on specials. Write, wire or call for samples, price lists and technical bulletins.

SINCE 1934 A EXTRUDERS FABRICATORS

ACE PLASTIC COMPANY 91-26 VAN WYCK EXPWY • JAMAICA 35, N. Y.

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LOOK TO THE MAN BEHIND THE MANUAL

before you buy bearings!

in the northeast

DONALD J. KNIZAK, MGR.

Northeastern Regional Office

New Hampshire Ball Bearings, Inc.

Peterborough, New Hampshire

Tel: WAlnut 4-3311

HE HAS ANSWERS TO problems not covered by our 150-page manual. An Instrument Ball Bearing Engineer, he's right in the middle of all new developments pertaining to instrument bearings. He can help you save days-and dollars-on your design projects.

HE WANTS to see to it that our manual is owned by every qualified engineer, draftsman and purchasing agent in his territory. Do you have one?

NEW HAMPSHIRE BALL BEARINGS, INC.

PETERBOROUGH, N. H.

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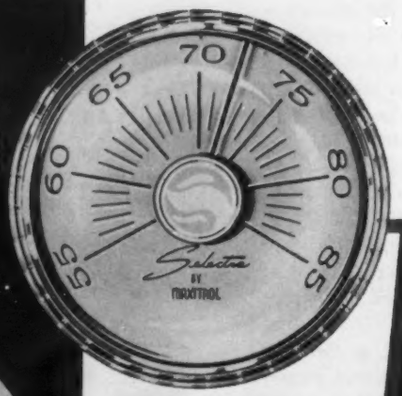
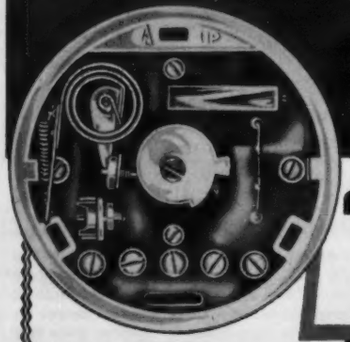
Chace Thermostatic Bimetal

ACTUATES ANOTHER PRECISION PRODUCT ...





MAXITROL

Selectrastat

A PRODUCT OF MAXITROL COMPANY, SOUTHFIELD, MICHIGAN

Maxitrol's "Selectra" system puts an end to cycling of forced air gas furnaces through continuous modulation of the flame. Because the modulation operates electronically, there is no time lag when more or less heat is needed. Inside the Selectrastat, a tiny thermistor no bigger than a pencil lead senses the slightest variation (as little as 1/10 degree) in room temperature. In less than one second it signals a printed circuit amplifier which immediately modulates the flame to provide the necessary heat.

In addition to modulation, the Maxitrol Selectrastat performs a second important control function. The thermistor controls only the modulator valve. In mild or warm weather automatic shut-off action is achieved thermostatically. A Chace Thermostatic Bimetal element performs this function, acting as the upper limit switch.

Maxitrol assures us that the Selectra system will give added convenience, accuracy and dependability. Chace is proud to have its only product—Chace Thermostatic Bimetal—included in such a system. Many manufacturers specify Chace Thermostatic Bimetal because it, too, is famous for dependability . . . a dependability born of more than a third of a century of *specializing* in one product: Precision Thermostatic Bimetal produced to specifications.

Send Now For Our New "Information Booklet"!

It contains many well illustrated pages of valuable design data and examples of successful applications of bimetal! More than 40 types of Chace Thermostatic Bimetal are available in coils, strips and completely fabricated elements of your design.

IT BENDS WITH THE HEAT

W. M. CHACE CO.

Thermostatic Bimetal

1612 BEARD AVE., DETROIT 9, MICH.

Circle 205 on Reader-Service Card for more information

RELEASES

• **MISSILE LAUNCH CAR,** developed for the Air Force Minuteman intercontinental ballistic missile system, has the general appearance of a passenger-type car. The car is shockproof because of a "three-way-stretch" cushioning system. It is 88 ft long over couplers and complies with basic requirements of the Association of American Railroads.

The 12-wheel vehicle uses hydraulic shock absorption for maximum protection from end impact and a compressed air reservoir that always returns the cushioning gear to a neutral position relative to the underframe following an impact. Air springs and leveling valves to keep coupler height constant whether or not the more-than-30-

ton missile is on board, standard helical springs for additional protection and special devices that decrease the effects of irregularities in the rails are also employed.

At the time of a missile firing, the car would come to a complete stop and a truck-lockout system would be engaged to temporarily lock the trucks to the underframe of the car. Then 12 jack pads would descend and raise the car into its final launch position. Connected to those jacks nearest the actual launch pad at one end of the car is a 10-ft-square steel flame deflector that lowers over the ties and rails and protects them from the missile blast.

The launch area door then slides toward the end of the car, leaving an opening directly over the launch pad. The main roof doors, each 45 ft long and half the width of the car, then open and the missile is raised to its launch position on the pad.

American Machine & Foundry Co. and ACF Industries, Inc., jointly designed, developed and produce the missile launch cars, as well as command cars that will be used for control and operations.

WATERMAN

Series 190

FLOW REGULATORS

Constant Speed Operation

regardless of load!

At a cost comparable to an ordinary restrictor or needle valve, you can have pressure-compensated flow control in your hydraulic circuits.

Rated for pressures to 3000 p.s.i.

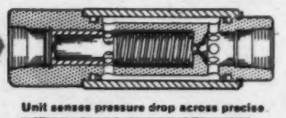
Wide range of sizes available—¼" to 1½" N.P.T.F. and ¼" to 1" S.A.E. tube.

Flows to 100 g.p.m. can be controlled.

Factory-calibrated and tested to ±10% tolerance. Closer tolerance available.

Require little more space than pipe or tube in which installed.

Trouble-free in operation—tens of thousands in use.



Unit senses pressure drop across precise orifice and reacts to control flow within desired limits.

Send today for new Catalog 1002.

NFPA

W-6105

WATERMAN

725 Custer Ave., Evanston, Ill.

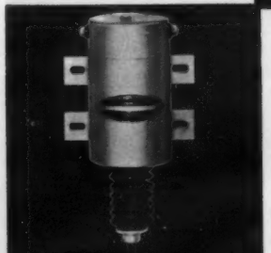
Circle 206 on Reader-Service Card

HEAVY DUTY D. C. SOLENOIDS

MODEL SL

VOLTAGES .....(D.C. Only) 6V. 12V. 24V. 32V.
CURRENT DRAW....(Pulling) 55A. 35A. 15A. 12A.
CURRENT DRAW...(Holding) 1.6A. .8A. .4A. .3A.
DUTY .....Continuous
CYCLES..... Not to exceed 6 per minute
PULL...Approximately 10 lbs. over ½ inch stroke
WEIGHT.....2½ pounds

Model SL


Model SD

MODEL SD

VOLTAGES .....(D.C. Only) 12V. 24V. 32V. 115V.
CURRENT DRAW....(Pulling) 40A. 20A. 15A. 4A.
CURRENT DRAW...(Holding) .5A. .25A. .20A. .05A.
DUTY .....Continuous
CYCLES..... Not to exceed 6 per minute
PULL...Approximately 10 lbs. over 1½ inch stroke
WEIGHT.....4¼ pounds
Model SM available with 1 inch stroke.

SYNCHRO-START PRODUCTS, INC.
8151 N. RIDGEWAY AVENUE • SKOKIE, ILL.

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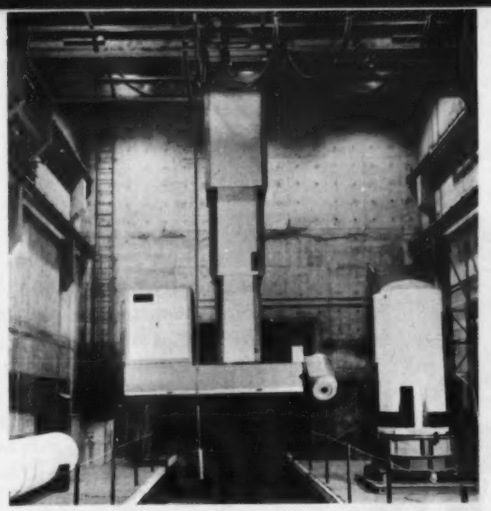
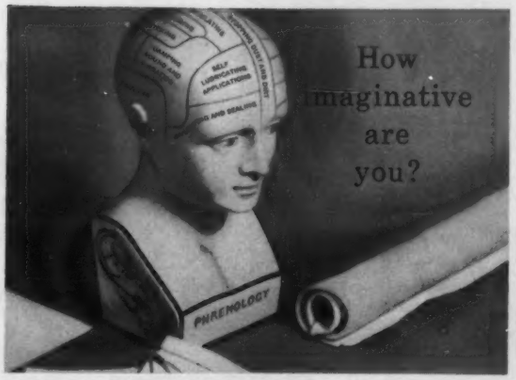


• **"LINAC"** is claimed to be the most powerful industrial linear accelerator in operation at this time. X-rays from this machine can penetrate six ft or more of solid propellant and locate tiny cracks and flaws. The machine is suspended from an overhead crane mounted in a concrete building.

According to Varian Associates, Palo Alto, designers and builders of the equipment, the 10-megavolt linac incorporates 14 inventions for which patent applications are being made. The machine is installed at the Quality Evaluation Laboratory, U. S. Naval Ammunition Depot, Concord, Calif.



Troyfelt, a family of synthetic felts in non-woven form, offers Dacron* and Orlon* in an entirely new dimension!

Troyfelt is a non-woven synthetic felt manufactured by an exclusive process which mechanically interlocks the fibers rather than relying on a binder chemical or fiber. This results in a uniformly stronger material.

We can make it to your specification for thickness, density or permeability. We can make it to match SAE specifications for thickness, weight and density. We can make it either of straight Dacron,* Orlon* or a blend.

You can use it for stopping or collecting dust or dirt . . . for polishing . . . for damping sound and vibration . . . for self-lubricating applications . . . for padding . . . for gasketing and sealing . . . for insulating . . . for wicking . . . wherever you need greater strength and abrasion-, chemical- and heat-resistance. And it can be made in so many different forms.

Send for samples and bulletin.

*Du Pont's Reg. T.M.

TROYFELT . . . by the pioneers in non-woven synthetic felts
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• **10,000-LB MAIN AXLE BEAM** for the landing gear of the B-70 intercontinental jet bomber is claimed to be the largest closed impression die forging ever made of H-11 alloy material. The dies used in fashioning the axle forging into its final complex shape weigh in excess of 140,000 lb. The axle was forged in a 125,000-MKG (meter-kilogram) counterblow forging hammer.

The die-forging process guides the grain flow of the metal in a controlled, predictable pattern. It permits forging to close tolerances and improves weight-strength ratios by compressing and densifying the material.

The axle beam was forged by Ladish Co., Cudahy, Wis.

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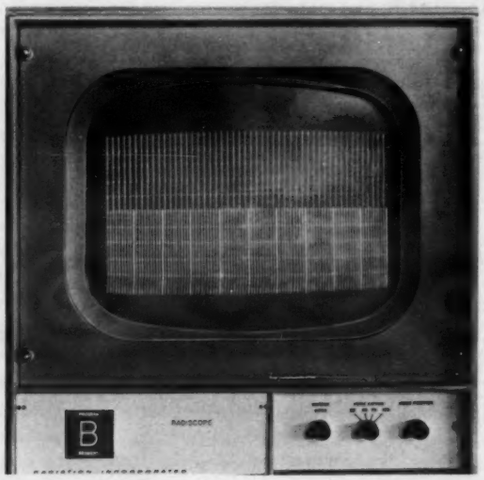
RELEASES

• **DATA DISPLAY SYSTEM** for the Minuteman ICBM program presents vital information in simplified bar graph form on the face of a cathode-ray tube. Called a "Raster Display", the system generates a predetermined pattern of scanning lines over a uniform area on the face of a cathode-ray tube, similar to that used in home TV sets. Superimposing technical data on the pattern intensifies different lines, thus creating the bar graph presentation. Digital logic circuits in the system operate six million times per second to generate the display.

Up to 400 channels of eight-bit broadside binary data are presented. Each bar contains intensified calibration markers electronically superimposed in 10-percent increments. Every tenth bar is intensified to enable easy channel identification. The display is accurate to better than ±1 percent of full scale.



BAR GRAPH DISPLAY with each tenth bar intensified for channel identification.

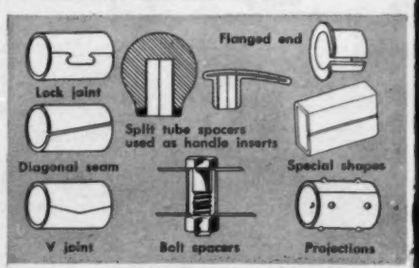
Incoming data is received at a rate of 12,800 data points per second. Each point is converted into vertical bars proportional to the value of the function. High data rates coupled with high accuracy requirements dictated use of digital logic circuits operating 6,000,000 times per second.

The data display system was designed and manufactured by Radiation, Inc.

with WAGNER SPACERS

Take another look at the components where you are now using screw machine parts, welded and seamless tubing, or iron pipe. Cost saving applications for Wagner spacers is uplimited . . . like the large spacer (shown above) which has inward projections at six points to hold the large shaft bearing in alignment . . . or the tiny spacer at right, similar to thousands we supply to electric appliance manufacturers to save the cost of screw machine parts. Let our engineering department analyze your requirements now . . . they are backed with over 60 years of experience and modern high speed facilities to produce at low cost!

Wagner spacers are available in: Lengths from 7/32" to 7"; I. D. from .100 to 2-1/16"; O. D. from .140 to 2½"; Wall thickness .020 to .187. We also make a wide variety of spacers with special features (as shown below) in brass, stainless steel, aluminum and steel!



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• **MULTIPURPOSE INDUSTRIAL CONTROL SYSTEM** is designed for a wide variety of uses which call for the frequent sampling and interpretation of data in the processing and manufacturing industries. These include quality control, industrial process study and process optimization.

The 1710 system is produced by International Business Machines Corp. and can scan up to 300 instruments at regularly timed intervals and provide instructions for the adjustment of control settings. It can also perform the calculations necessary to build a mathematical model or description of a process. This is an important preliminary step to the development of the standards and program for the control of a specific industrial operation.

In manufacturing quality control, the 1710 can be used in analysis and recording of the final test of such diverse items as transistors and refrigerators as they come off an assembly line. With the 1710, every unit can be inspected automatically, replacing random checks. In addition, the computer evaluates the units, or groups of units, and indicates where modification of manufacturing steps may be necessary to eliminate flaws.

The 1710 is composed of a data converter, which translates instrument readings into language understood by a computer, and a solid-state data processing system.

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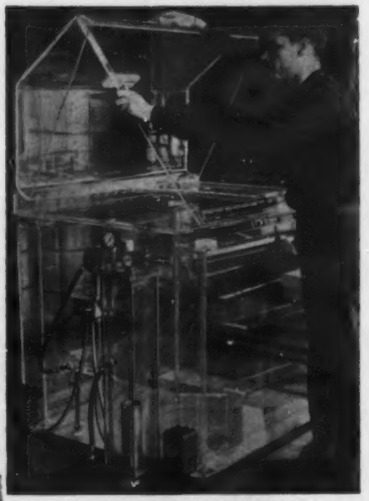
- Salt Fog
- Humidity
- Acetic Acid
- Corrodkote
- Cass Tests

Meet A.S.T.M. and Government Specifications



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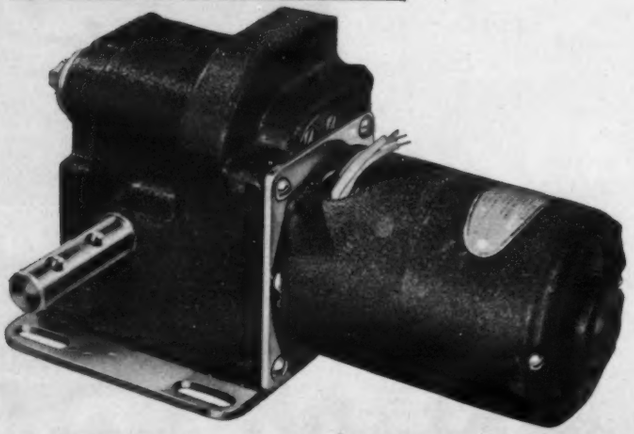
CPE*



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The power unit on an automatic garage door opener must be powerful and dependable so that garage doors may operate under all kinds of weather conditions. That's why Purdy Door-Operator Corporation chose MAMCO electric motors.

MAMCO specializes in custom-built motor applications —not just adapting standard units with too much or too little power to your products—but universal or shaded pole motors custom designed for specific requirements—to make your product perform better and last longer. Call, wire or write MAMCO today—you'll be surprised at how little it costs for

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Racine, Wisconsin

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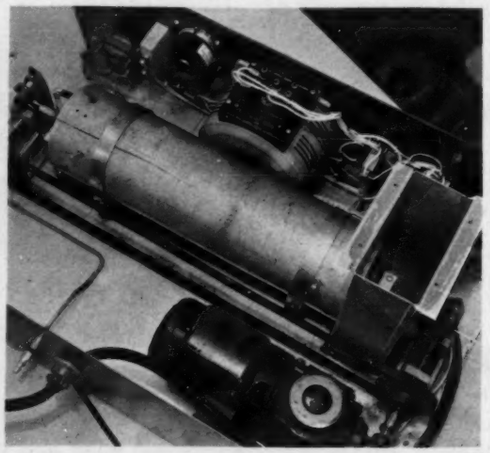
RELEASES

• **AUTOMATIC SINTERING PROCESS,** using an especially designed oven, permanently marks "Teflon" insulated wires. The identification codes marked on the "Teflon" withstand vibrations, temperatures and exotic fuels associated with missile and space systems.

The wire is identified with a "Teflon" foil marking and the sintering causes a chemical fusion of the "Teflon" insulation and foil. Result is a permanent identification which cannot be removed without destroying the insulation.



The sintering oven uses quartz infrared tubes to produce radiant heat which is absorbed quickly by the dark marking on the insulation. Oven temperature is controlled by a "Variac" power transformer connected to a 110v a-c receptacle.

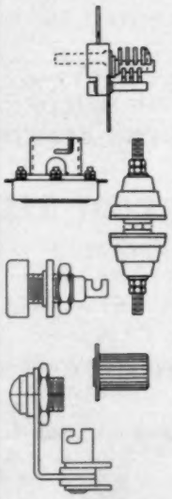
A vari-drive mechanism feeds wire through the oven at a predetermined rate for the particular temperature and wire size. Cooling fans help control sublimation of the heated "Teflon", and toxic fumes are exhausted through a stack.

The sintering oven and process were developed by The Martin Co. for sintering wires in gauges 20 through 16. A production model for sintering other sizes is nearly completed.

NEW!
ELECTRONIC COMPONENTS CATALOG

8 MAJOR PRODUCT LINES

Catalog 978—a complete listing of all electronic components in the E. F. Johnson line . . . includes photos, engineering prints, specifications and current prices.



1. Air Variable Capacitors
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Small compact couplings, PUSHOMATIC one-hand connect or disconnect. Automatic locking — high-pressure connection. Maximum flow.

- One-hand operation
- Automatic action
- Integral shut-off
- 360° swivel action

INTERCHANGEABLE

Interchangeable with all popular makes. Fast, easy one-hand "push" action connects or disconnects lines instantly.

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Full unrestricted flow. Same inside diameter as nominal pipe or supply hose. Sleeve action. Fast transfer of media.

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Shut-off valve in socket and plug stops the flow from both lines when disconnected. One-hand operation.

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All disconnects available from stock in various metals, end connections and sizes. Write for Bulletin 1475.

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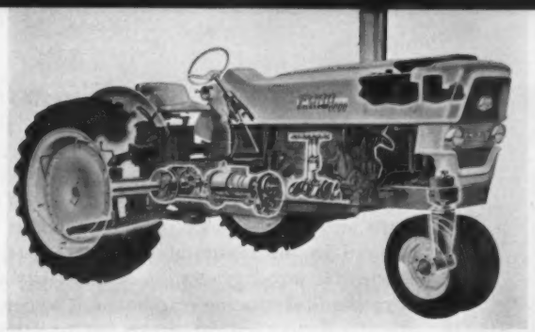


LOCATIONS of major components are shown. Hydraulic accumulator is located in front.

• **LARGEST TRACTOR** ever built by the Tractor and Implement Div. of Ford Motor Co. is rated as a five-plow unit and weighs in excess of five tons when fully loaded. The tractor has a wheelbase of 95 inches and an overall length of 149 inches.

A new six-cylinder diesel engine was developed with a displacement of 242 cu in and a compression ratio of 16.5:1. The engine is rated at 85 bare engine bhp and 60 drawbar hp. Drawbar pull is rated at 7000 lb.

A hydraulic power accumulator system stores up hydraulic power during periods of low demand. This hydraulic power is released during peak requirements. The accumulator tank, located in the protected area behind the tractor's cast-iron front end, contains a free piston which separates a volume of an inert gas from varying quantities of hydraulic oil.

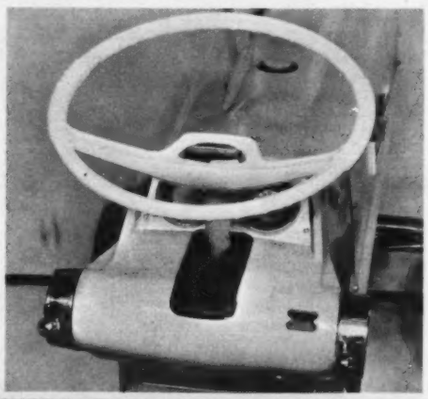
As oil enters the accumulator through an automatic valve, the gas creates hydraulic energy by exerting pressure on the piston to compress the oil. The combined gas and oil pressures generate hydraulic pressure within the tank of about 2300 psi.

Only five engine hp are required, intermittently, to operate the oil pump supplying the needs of the tractor's hydraulic system. Ford engineers estimate that 15 hp would be needed, intermittently, were the accumulator not employed.

The two-position steering wheel, correctly placed when the operator is seated, can be tilted without relinquishing control to a more nearly horizontal position when the operator wishes to stand. The operator, from his seat, can power-adjust the tractor's rear wheels to tread settings of 56 to 90 inches.

The tractor also is equipped with power steering and power brakes. A power-shift 10-speed transmission requires no clutch pedal.

TWO-POSITION STEERING WHEEL is shown in position for standing operator. Slight press and upward push shifts steering wheel backwards. Two universal joints in steering column assure constant steering control regardless of steering wheel angle.



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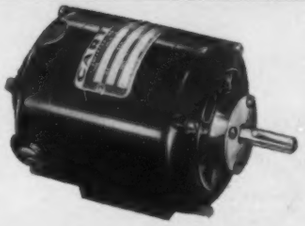

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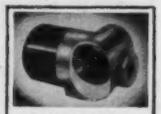
1/35 to 1/10 hp.

Then switch to Carter Classic

Interchangeable with competitive types. Exclusive performance features include longer brush life, instrument quality ball bearings in steel sleeved housings, highest quality die-cast construction.



Carter also offers a line of 45 miniature Motors and gearmotors 1/1000 to 1/10 hp.

6 to 220v. Series Models . .
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As your specialty motor source, there are no restrictions on modifications, no long delivery, no minimum orders . . . just friendly, personal attention to your requirements.

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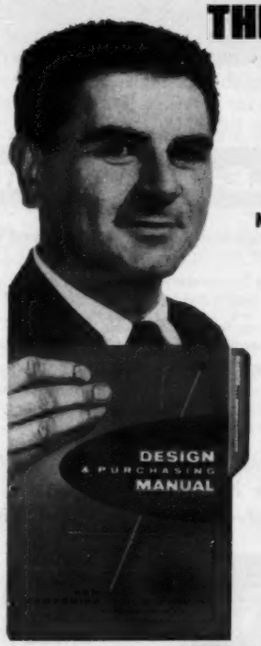

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ROPER PUMPS

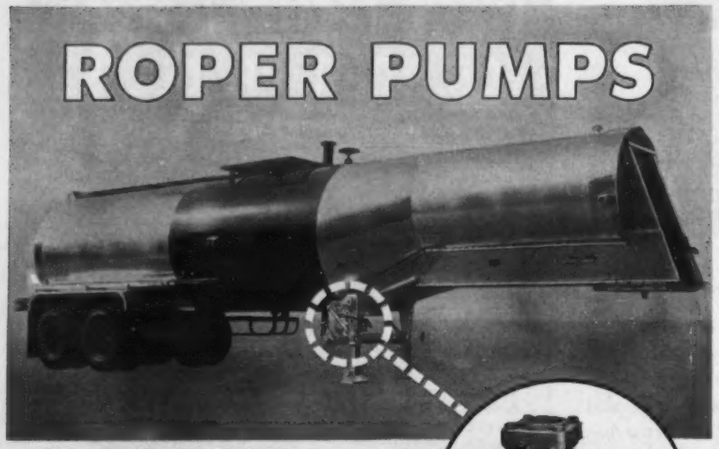

Photo courtesy Great Dane Trailers, Inc.

SERIES 3600

handle widely different products in dual-purpose tank trailers

CAPACITY: 40-300 GPM • PRESSURES TO 100 PSI

A fleet of dual-product trailers built by Great Dane Trailers, Inc., Savannah, Ga., hauls tall oil, a highly viscous resin by-product, one way and returns with low viscosity gasoline. Roper Series 3600 MAHBRV #4 tank truck pumps were installed on these trailers because of this necessity of handling widely different products. Each pump is directly connected to the tank trailer and to a discharge pipe which permits controlled unloading from either side of the trailer. Each pump is equipped with a relief valve. Series 3600 pumps are available in high- or low-drive models for clockwise or counter-clockwise rotation. They can be side frame or cradle mounted on right or left side.

FOR DOUBLE-DUTY SERVICE

- **BEARINGS:** service-free high-lead bronze, lubricated and cooled through oil grooves by flow of liquid through pump.
- **OUTBOARD BEARING:** heavy-duty ball bearing diverts drive and thrust loads from pumping gears and inner bearings.
- **GEARS:** two equal-sized, hardened alloy iron, helical-type gears with accurately machined special tooth forms reduce friction, eliminate vibration.
- **PACKED BOX OR MECHANICAL SEAL:** extra deep packing box easily repacked with split ring packing and split gland without disconnecting drive or piping. Mechanical seal (3605) is self-adjusting with precision-lapped mating surfaces for positive sealing and long life.

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Send for "How to Solve Pumping Problems" booklet

ROPER HYDRAULICS, INC.

Dependable pumps since 1857

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RELEASES

• **THERMIONIC CONVERSION DEVICE,** known as a plasma diode, uses tremendous heat produced in the center of nuclear reactor fuel elements for direct generation of electricity without mechanical rotating equipment. The converter produces electrical current by boiling electrons off a cathode, or hot metal plate, and collecting them on an anode, a cooler plate.

The plasma diode now under development is a high-temperature thermionic device using cesium gas and a uranium-bearing cathode. These diodes would be built into nuclear fuel elements, where fissioning of the uranium in the cathode would provide the high temperatures—in the range of 4500F—needed for efficient direct conversion. An electrical lead from the fuel element would draw off the electricity.

In addition to directly produced electricity, lower temperature heat rejected through the walls of the fuel element also would be used to produce electricity by boiling water to make steam for the operation of turbine generator facilities.

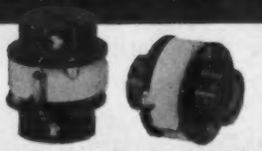
Although thermionic conversion devices capable of producing approximately 20w per sq cm of cathode area have been demonstrated, present thermionic converters are still a long way from practical application. Recent design advances, however, lead scientists to believe they can have an advanced plasma diode ready to be installed in a thermionic fuel element and tested in a prototype nuclear powerplant within five years.

The plasma diode thermionic conversion device was announced by General Electric Co.

TINY PELLET seen below plasma diode capsule is special uranium-bearing cathode which will provide high-temperature fission heat for diode to convert directly into electricity.

TIC OF ACTON

MINIATURE FLEXIBLE COUPLINGS



FEATURE • No Backlash • Compactness and Lightweight • Accommodate both lateral and angular misalignment • Choice of types offer clamping or set-screw hubs

Type MPC-1 consists of two flanged aluminum hubs and nylon or Delrin discs with V-grooves that are displaced 90° with each other. Discs are fastened with stainless steel springs loading ball pivots against V-grooves. Dimensions ⅞ x ⅞ in.
Type MPC-2 has two cylindrical aluminum hubs, each with two ball pivots attached. Hubs are attached to a pair of flexible phosphor bronze discs which hold and load the ball pivots. Dimensions ¾ x ½ in. Both types have range of bores to accept shafts from .120" to .250" and meet MIL-E-4970 and withstand −80° to 200°F and shock to 100 G.

TIC OF ACTON

ADJUSTABLE SLIP CLUTCHES

FEATURE • Adjustment over a wide torque range • Compactness and lightweight

Type ASC-1 is ⅜ x 1"
Type ASC-2 Miniature is ⅝" x ⅝"
Both are constructed of aluminum hubs, Delrin* on stainless steel clutch plates and stainless steel hardware. These rugged, high performance clutches are friction units to protect components against excessive or inertia shock loads. Range of bores to accept shafts from .120" to .250". These clutches meet MIL-E-4970 specs.

For details on couplings or clutches write

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Acton, Massachusetts

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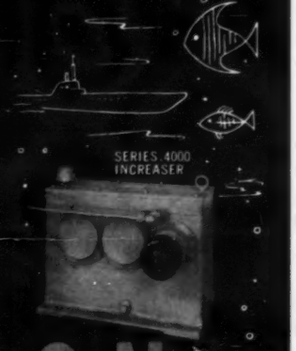
for way up here

S-N

S-N engineers want to recommend the best high speed gear increaser for your test applications.
S-N wants to tell you why S-N units have been chosen by engineers for aero-space systems as well as atomic submarines.
S-N wants to send you a bulletin about a specific application of interest to you.
S-N wants you to write Industrial Division The Snow-Nabstedt Gear Corporation, Hamden, Conn.



S-N

for way down here

Circle 224 on Reader-Service Card

• AUTOMOTIVE GAS TURBINE ENGINE with "variable nozzle" system provides rapid acceleration and engine-braking characteristics. The variable nozzle system has solved three problems: (1) the low-speed, part-load fuel consumption of gas turbines; (2) lack of engine braking characteristics, and (3) the time lag between the pressure on the accelerator and the full power response of the engine.

The engine is a two-stage turbine powerplant with two turbine wheels rotating at approximately 45,000 rpm. Inlet temperature is 1700F. The first turbine wheel produces the power necessary to operate the compressor, pumps and other components. The second turbine wheel generates power and transmits it through a reduction gear.

Before the hot gas reaches this second turbine wheel, it must pass through 23 vanes arranged in a circle which direct the gas at the wheel blades to provide maximum thrust effectiveness.

Each of the 23 nozzles is actually an airfoil-shaped blade mounted on the end of a shaft. At the other extremity of the shaft is a crank with a ball-shaped end. This ball rides in a groove in a ring. The appearance is somewhat similar to a ball bearing with a slotted outer race.

There are 23 shafts and 23 ball-ends set in the individual grooves. The ring rotates a few degrees, actuated by a rod and a lever from an automatic control piston and this in turn swings the shafts which turn the blades as much as 100 deg.

By varying the pitch of the vanes, higher cycle temperatures during all phases of operation can be maintained. By almost reversing the vanes, a reverse effect on the drive turbine can be developed with a resultant braking effect.

Weight of the engine, including the reduction gear and the starter generator, is under 450 lb. It delivers 140 hp and provides vehicle performance comparable to that of a 200-hp piston engine. Fuel consumption is comparable to that of the piston engine.

The gas turbine engine was developed by the Chrysler Corp. and is installed in its new experimental car called "Turboflite". The car chassis was developed by Chrysler engineers and the body was hand-built by Ghia craftsmen in Turin, Italy.

WATLOW'S

FIREROD

OUTHEATS...

OUTLASTS...

OUTPERFORMS

ANY OTHER

CARTRIDGE HEATER!

OUTHEATS—because Watlow's FIREROD® produces up to eight times as much heat as any standard cartridge unit—or will give as much heat as a standard unit in ⅛th the space.

OUTLASTS—Watlow perfected the exclusive construction techniques that permits the FIREROD® to operate at lower internal temperatures. Better heat transfer from the resistance wire to the sheath permits high operating temperatures without excessive internal temperatures which cause burnouts. Laboratory and field tests have proven FIREROD'S® superiority when tested with *any other cartridge heater*, including competitive so called "high watts density" units.

OUTPERFORMS—Proven longer life—less replacements and down time—up to 8 times as much heat as other standard units or the same heat in ¼th the space—and at a price only slightly higher than a standard unit. Deliveries two weeks or less.

WHEN YOU SPECIFY CARTRIDGE HEATERS SPECIFY WATLOW'S FIREROD

Bulletin 367 will give you complete information.

WATLOW
ELECTRIC MANUFACTURING CO.
1378 Ferguson Ave./St. Louis 14, Mo.

6102

Circle 225 on Reader-Service Card for more information

PRECISION-MADE SOLDERLESS TERMINALS

Immediate delivery on any type, any size . . . designed to fit most types of crimping tools

The progressive die-stamping pictured above is just one of the up-to-date production techniques that insure the high quality of Hollingsworth terminals. Fashioned from pure copper of the highest grade, all Hollingsworth terminals are meticulously manufactured to provide a completely reliable, vibration-proof connection.

Hollingsworth manufactures 16 types of solderless terminals as standard. They also custom-design solderless terminals for special applications. Whether your terminal requirements are ordinary or extraordinary, Hollingsworth can fill them to your complete satisfaction.

- Full ¼" working shank
- Load capacity greater than that of the wire
- V-type grooves in throat grip wire securely
- Insulated types are color-coded according to size
- Beveled mouth for fast, easy wire insertion

Write for Hollingsworth catalog

HOLLINGSWORTH COMPANY

Solderless Terminal Division

PHOENIXVILLE, PENNSYLVANIA

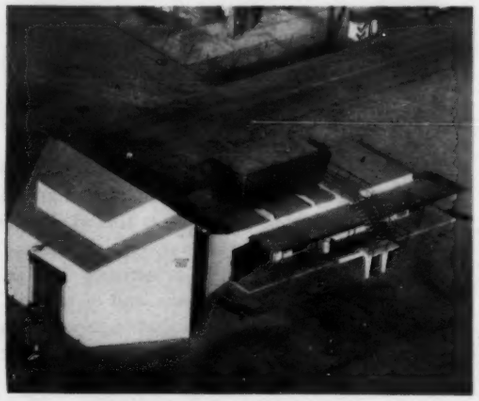
SA 2120

Circle 226 on Reader-Service Card for more information

RELEASES

• **SONIC TEST LABORATORY** impinges high-intensity noise on specimens at sound pressure levels up to 170 db. Simultaneous cooling or heating of specimens is possible from temperatures of —100 to 1200F.

High-intensity noise is produced by two sirens, each covering a different frequency range. Compressors which activate the sirens are powered by two 400-hp electric motors. Extending from the sirens is a catenary horn, a double-shelled structure of 12-inch-thick steel-reinforced concrete. This horn-shaped structure is 71 ft long and 40 ft wide at extremes, containing a test room of identical shape, with a dead-air space between the two.



Specimens up to 3 by 5 ft can be accommodated in the grazing incidence test section, while an object 6 by 25 ft can be placed in the main test room for study under reverberant or progressive wave sound fields.

The test room becomes an anechoic-like (no echo) chamber merely by lowering a curtain of wedge-shaped baffles at the rear of the chamber. When the curtain is raised, a reverberant sound field is again restored.

Test specimens are monitored by strain gages and amplitude pickups and viewed remotely in the control room on a closed-circuit television system.

Bolt, Beranek and Newman, Inc., Cambridge, Mass., designed the facility for North American Aviation, Inc.'s AeroSpace Lab., El Segundo, Calif.

How to use FLUID POWER

✓ **efficiently**
✓ **economically**
is as easy as . . .

when you specify

PROVEN QUALITY SP CYLINDERS • BOOSTERS

SERIES A

Standard Cylinders AIR or OIL Without Modification

Save money with S-P's complete line; rated 200 psi air, 500 psi oil or water; 23 mounting types; 11 bore sizes—1½" thru 14"; see Catalog 110C.

SERIES B

HIGH PRESSURE Hydraulic Cylinders

Get smoother, more precise power; ruggedly built, interchangeable; 2000 psi (3000 psi non-shock); 12 bore sizes—1⅛" thru 12"; get Catalog 117.

SERIES C

Air-Oil BOOSTERS

Save money, save space; boost 80 psi line air to 3000 psi hydraulic power with no added power consumption, no maintenance; see Catalog 116.

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A-2883A

The S-P Manufacturing Corp.
A. BASSETT COMPANY
30201 Aurora Road • Cleveland 39, Ohio

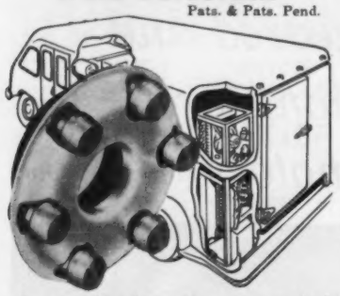
Circle 227 on Reader-Service Card

ANOTHER IDEA

USING **TORQ**

SPEED DETECTORS

Pats. & Pats. Pend.



In a truck refrigerating system which uses the truck engine to drive the alternator, the ingenious use of a TORQ speed detecting centrifugal governor results in useable alternator output over practically the entire speed range of the truck engine. This is done by the TORQ switch automatically shifting down the truck engine input speed to the alternator over 1800 rpm, thus maintaining proper voltage to frequency output for proper operation of blower and compressor motors.

TORQ speed detecting/control devices are snap acting, centrifugal switches. They actuate on speed alone, are virtually frictionless in operation, are built to specification tolerances at speeds from 0 to 15,000 rpm and are rated up to 1.5 million cycles of uniform operation.

• **METER SCALES,** using speed as the measurement function, use TORQ switches to automatically change scale ranges for continuous, direct reading of all scales without manual controls or mental calculations.

• **ELECTRONIC EQUIPMENT** is protected against overheating with a TORQ switch to cut out circuit in event of cooler blower failure.

• **MISSILES** are afforded ballistic accuracy with a TORQ switch to control rpm.

If your equipment employs a rotating shaft, you can use a TORQ switch.

THE WORLD'S LARGEST MANUFACTURER OF SPEED DETECTORS

TORQ

ENGINEERED PRODUCTS, INC.

30 West Monroe Street Bedford, Ohio

Phone: BEdford 2-4100

Circle 228 on Reader-Service Card

• **THERMOELECTRIC AIR-CONDITIONED SUIT** can keep the wearer comfortable in outside temperatures ranging from —40 to 135F. The suit is an experimental model for testing the possibility of air-conditioned attire for military personnel.

Heating or cooling of the experimental garment is done by thermoelectricity. Cooling is accomplished by passing an electric current through thermoelectric couples made of semiconductor materials. Reversing the current causes the materials to heat instead of cool. Heating or cooling is done automatically, and a temperature of about 80F is maintained inside the garment.

Completely airtight, the suit is made of an insulated aluminum-coated fabric. Air for breathing is supplied through a face mask connected to the side of the suit helmet, where incoming air is heated or cooled by a small heat exchanger.

During cooling, the current flow through the elements causes one end of the thermoelectric couples to cool, thus lowering the temperature of the heat exchanger on the inside of the suit. The heat removed from the cool side flows through the thermoelectric elements to the hot-side heat exchanger, from which it is dumped to the atmosphere by a small fan. Another fan, mounted on the same shaft, circulates the cool air within the suit.

The only moving parts in the suit's entire air-conditioning system are the two small fans. Batteries permit the suit to be independent of any other power source for one hour.

The thermoelectric air-conditioning unit was designed and built at the Westinghouse New Products Laboratories, Pittsburgh, Pa.

AIR-CONDITIONING UNIT that both heats and cools is fitted to back of suit.

unusual magnets for unusual applications

Shape is not the only unusual thing about these ceramic magnets! Most important is *how* and *where* they can be used. For *Ceramagnet*® is a basic, new design material — not a substitute for conventional metallic magnets. It allows magnetism to be creatively applied in new and better ways — usually at low cost — to literally hundreds of products from small motors, generators, coupling drives, holding devices, and filters, to lightning arrestors, sonar equipment, switches, and many others.

Ceramagnet permanent magnets are electrically non-conductive and chemically inert. They may be used without keepers and pole pieces, with many poles on one face, and under other conditions which would quickly demagnetize conventional magnets.

Where can Ceramagnet fit into your application? For ideas and technical data, send for Stackpole Bulletin RC-12A.

STACKPOLE CARBON COMPANY, St. Marys, Pa.

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CERAMAG® FERROMAGNETIC CORES • SLIDE & SNAP SWITCHES • VARIABLE COMPOSITION RESISTORS • FIXED COMPOSITION CAPACITORS • BRUSHES FOR ALL ROTATING ELECTRICAL EQUIPMENT • ELECTRICAL CONTACTS • GRAPHITE BEARINGS & SEAL RINGS • COLDITE 70+® FIXED COMPOSITION RESISTORS • AND HUNDREDS OF RELATED PRODUCTS

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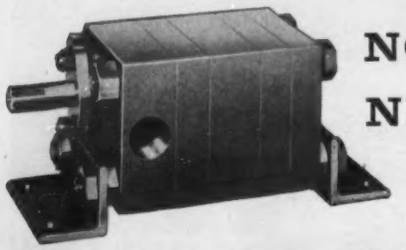
Proven in thousands of installations



NORTHERN NITRALLOY PUMPS

Northern Nitralloy Pumps are noted for their ability to handle difficult pumping assignments. They're able to do so because they are built to tolerances of extreme accuracy from a variety of metals. Rugged design plus precision construction equals years of good service.

Pump sections and parts are interchangeable and can be made from Nitralloy, ni resist, cast iron, steel, stainless steel, bronze, aluminum and other metals. This permits designing pumps for virtually any application.

Northern Pumps are available in capacities from ¼ to 146 gpm at pressures up to 2,000 psi. For free catalog and engineering data, write today.

Northern Ordnance Incorporated
Subsidiary of NORTHERN PUMP COMPANY
Minneapolis 21, Minnesota
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NO TANGLE-NOTCH COIL

brazing rings

Snap OFF COIL
PLACE ON PART

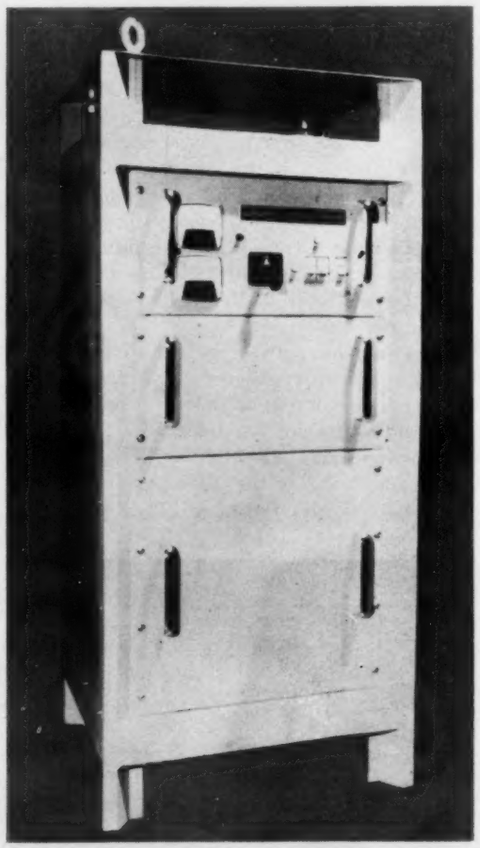
Preformed No Tangle-Notch Coil Rings end wasted time in placing silver solder in position for brazing operations. Rings fit quickly and accurately on parts to be joined. Cut and try methods and resulting rejects are eliminated. Silver solder is actually metered to flow evenly — positive bond. Ring Diameters from ¼" to 12" — +.001. Wire Sizes .020 to .093.

Write for 16 page booklet on better brazing.

LUCAS-MILHAUPT *Engineering Co.*
5054 South Lake Drive, Cudahy, Wisconsin
Circle 231 on Reader-Service Card for more information

RELEASES

• **STATIC INVERTER POWER SUPPLY,** designed for computer, utility and military applications, converts d-c power from a 129v battery source to 115v, single-phase, 60-cycle a-c. The unit incorporates a silicon-controlled rectifier as the principal power-regulating device and features convection-cooling to provide lower preventive maintenance. Efficiency reaches as high as 80 percent over a range from +10 to —18 percent VDC.

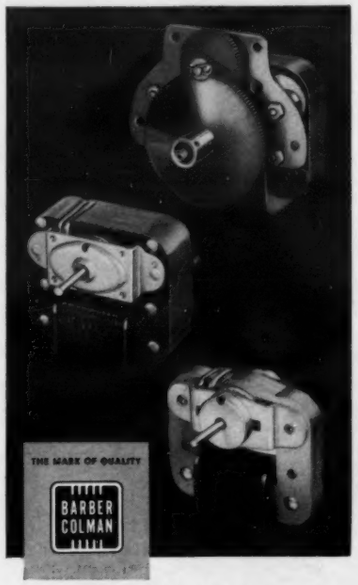


During normal operation, a-c input power is converted by a battery charger to d-c which supplies the inverter. A battery (60 lead-acid or 92 nickel-cadmium cells) is floated on the input to the inverter.

When a-c power fails, the battery supplies the inverter with no interruption occurring in the a-c output of the inverter.

The static inverter power supply has been developed by General Electric's Low Voltage Switchgear Dept.

Barber-Colman unidirectional, geared and nongeared motors (up to 1/20 hp)



Outstanding for their high starting torque and low-inertia rotors. Precision-made for commercial and industrial applications such as appliances, vending machines, projection equipment, office machines, displays, toys, pumps, blowers, and fans. Shaded pole type, 115 volt a-c (220 volt optional) . . . up to 1/20 hp. Low noise level . . . long-life lubrication . . . high dielectric strength coils . . . stainless steel shafts . . . quality guaranteed!

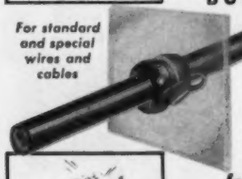
WRITE FOR QUICK REFERENCE FILE
Gives typical specifications on the complete line of Barber-Colman a-c small motors: unidirectional, synchronous, reversible. With or without reduction gearing. Open or enclosed types. Stator and rotor sets also available.

BARBER-COLMAN COMPANY
Dept. P, 1210 Rock Street, Rockford, Illinois
Circle 232 on Reader-Service Card

HEYCO NYLON BUSHINGS!

HEYCO STRAIN RELIEF BUSHINGS

For standard and special wires and cables



The Approved Standard for Insulating and Anchoring ELECTRICAL CORDS & CABLES

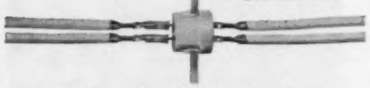
Approved HEYCO

Snap Bushings

Insulation and mechanical protection for electrical wire & cable, hose, tubing & rope—a bearing for moving parts.

Finger pressure snaps and locks bushing into panels of varying thickness up to ⅛"

HEYCO JUNCTION-TERMINAL BUSHINGS



Miniature Insulated Receptacle

Eliminate "Pig-Tail" Wire Leads
Mate with 3/16 or 1/4" female terminals

COLOR CODED

HEYCO®

HEYMAN MANUFACTURING CO.
KENILWORTH 5, NEW JERSEY

FREE SAMPLES: Which bushings would you like?

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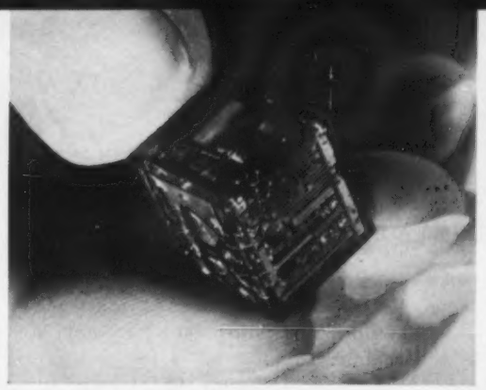


AMPLIFIER is part of infrared guidance system. It boosts power to servoamplifiers. Solid block of plastic contains transistor, diodes, resistors and capacitors.

• **SOLID BLOCK PACKAGING** of missile components permits reduction in size by a factor of 6:1. Weight can be reduced 75 percent. Plastic blocks protect the components against shock, vibration and moisture.

The assembly method uses a special expandable jig holding two sheets of film, each printed with a standard grid. These grids form a three-dimensional envelope within which components and connecting wires are assembled.

Holes punched in film hold component leads firmly in place. While still in the jig, circuit elements are precision welded.

Energy input and output are concentrated on one side in a pattern that is the same on all packages. Connections between modules are made by circuit-board strips that take the place of the usual harness assembly.

The technique was developed by Convair (Pomona) Div. of General Dynamics Corp.

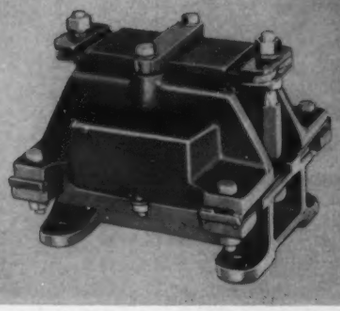
• **FIRST PRODUCTION P3V-1 ASW AIRPLANE,** built by Lockheed's California Div., has rolled off the assembly line. The four-engine P3V-1 is scheduled to take over duties currently accomplished by P2V Neptunes. Its five-fold mission is to detect, locate, identify, classify and destroy enemy submarines.

Carrying armament for both surface and underwater attacks, it will be capable of striking with torpedoes, depth charges and special weapons launched from a large bomb bay, plus rockets fired from wing pylons. Super-sensitive detection gear utilizing sound, magnetic and electronic waves can be integrated, or operated separately, to pinpoint target location.

The P3V-1's 136-inch-dia fuselage provides ample room for comfortable, console-type tactical compartments. Members of the crew, 10 in all, will have a complete galley and rest area to help keep them in combat readiness during extra-long missions.

KEEP BULK MATERIALS FLOWING FREELY

SYNTRON ELECTRIC VIBRATORS



ASSURE STEADY MATERIALS FLOW FROM BINS, HOPPERS, CHUTES

Syntron builds an Electromagnetic Bin Vibrator unit to meet almost every requirement. Prevents most types of bulk materials from arching or plugging in bins, hoppers, and chutes.

The Electromagnetic drive unit produces 3,600 instantly controllable vibrations per minute, providing a steady materials flow to processing equipment.

Every Syntron Electromagnetic Bin Vibrator is rugged and durable. The absence of mechanical moving parts assures long, trouble-free service with very little maintenance.

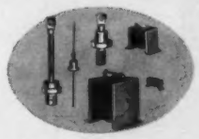
Keep bulk materials flowing efficiently and economically.

Write for a Syntron Catalog and the name of the representative nearest you. 6IV5

SYNTRON COMPANY
890 Lexington Avenue • Homer City, Pa.

Spiral Elevators

Packer & Jolters



Silicon & Selenium Rectifiers

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BEAVER
BALL SCREWS

Successor to the Acme screw drive and preferred in many applications to hydraulic and pneumatic systems. Guaranteed 90% efficient in converting rotary twist to linear push (or vice versa). Employs a stream of precision balls and ground lead to eliminate drag and wear in delicate instruments, aircraft, machine tools, massive wind tunnel jacks, etc. For horizontal and vertical actions, indexing, inching and traversing. Consultation and engineering service available. Write for literature.

• EXTREME ACCURATE POSITIONING • NO BACKLASH • RAPID START • ANY DIAMETER OR TRAVEL •

Beaver Precision Products INC.
CLAWSON, MICH.

Circle 235 on Reader-Service Card

PLANS AND CROSS-SECTIONS

Lunar Landings on a Doughnut

A special doughnut-shaped inflatable fabric ring has been designed to cushion the landing of a space vehicle on the moon or planets. Packed around the sides of the vehicle, the deflated coated-fabric tubing would be positioned below the payload as the space craft slowed for landing, braced and then inflated to soften the impact.

"The "pneumatic decelerator" is the idea of engineers at Goodyear Aircraft Corp. They have used a series of air drops, duplicating lunar rebound and stability conditions, to test the device. The tests proved the device would bring a heavy load to rest safely even on hard rocky or sloped surfaces such as are expected on the moon.

Landing on the moon sounds like a pretty soft job. Volunteers?

Walking Made Easy

A University of Michigan mechanical engineering professor has designed a "walking machine" in a feasibility study for the Army's Land Locomotion Laboratory. According to Professor Joseph E. Shigley, a walking machine may find many uses. The vehicle could go faster than a wheeled or tracked vehicle over certain types of terrain.

The "walker" could flail over plowed fields at 30 mph, he believes. Top speed would be 40 to 50 mph.

As Professor Shigley designed it, the perambulating machine would have 16 legs—four each on four corners. The legs on each corner would work like this: while one was actually making the stride, the second would be lifting off the ground to return for another stride, a third would be returning and the fourth lowering for its step. "When it moves in a straight line over rough terrain," he explained, "there won't be anything for the operator to do but sit there." Walking made easy!

How to Keep 'em off Your Bumper

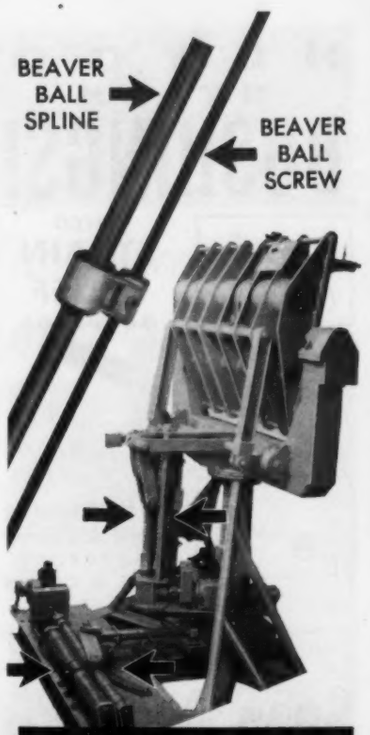
If you dislike bumper hangers, a recently patented device will interest you. Automobile drivers who habitually follow cars in front of them too closely are warned by blinking lights to widen the gap.

The lights are set off by a pulse-echo detection system which automatically measures the distance between the front and rear car. When the critical safe distance is encroached upon, the warning system transmits a signal to the back lights. The detection system also contains a filter that rejects unwanted echo signals reflected from stationary objects or automobiles moving in another direction. Lester H. Nordlund of Tacoma, Wash., devised the device.

Bottles, Bottles Everywhere

Thousands of bottles will be cast into the Pacific Ocean near the Hawaiian Islands this year to study the ocean currents. It is the first large-scale study of its kind in the mid-Pacific. Bottles cast adrift and washed ashore will provide information on the direction and speed of the ocean currents near the Hawaiian Islands.

Looks like we'll have to make a few c-h-a-n-g-e-s, eh, Bill?



B-58 HUSTLER DOPPLER ANTENNA TEST FACILITY

Beaver Ground Thread Ball Screws and Ball Splines Combine for Ultra-Precision Actuation

The demand for rigid, smooth, precise control in azimuth and elevation positioning is about as great as it comes in this production test facility designed by Equipment Division of Raytheon Company.

In machine tools and devices where high efficiency, accuracy over long distances of travel, system stiffness and compactness are desirable, Beaver engineers will be glad to work with you.

Beaver Precision Products INC.
CLAWSON, MICH.

Circle 236 on Reader-Service Card

IT'S A FACT

YOU CAN DO BETTER WITH

DE-STA-CO

CLAMP-ABILITY

No matter what the size or shape, when you need constant, accurate holding power, the sturdy "clamp-ability" of De-Sta-Co Toggle Clamps is the answer.

More than 25 years of manufacturing experience is reflected in each of over 140 models—from the 1-oz. Tiny Toggle with 50 lbs. holding pressure to the giant 5-lb. model with 2-tons of clamping force.

And for the unusual application, our engineers will show you how easily one may be adapted. Inform yourself about De-Sta-Co "CLAMP-ABILITY" . . .

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YOU CAN
DEPEND ON DE-STA-CO

DETROIT STAMPING COMPANY
DE-STA-CO
350 MIDLAND AVENUE
DETROIT 3, MICHIGAN

Circle 237 on Reader-Service Card

• **"DARK HEATER"** for receiving tubes greatly extends their life and improves their performance. The "dark heater" derives its name from an especially processed gray insulation coating which is applied to the heater wire. Heaters of conventional tubes utilize a white coating.

The dark heater operates up to 350K below the 1500 to 1700K of the white heater. The dark surface radiates heat more efficiently and improves the transfer of heat to the cathode so that optimum cathode temperature may be attained with the heater operating at approximately 1350K.

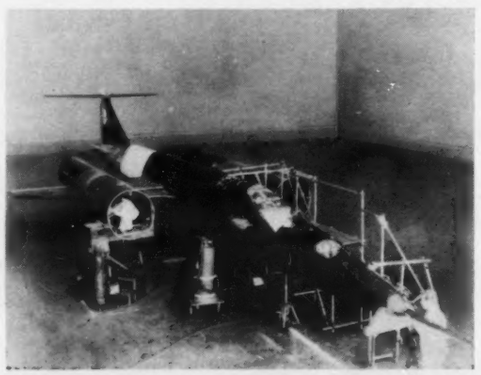
Reduced heater temperature results in lower internal stresses in the heater wire and smaller thermal change during heater cycling. This lessens chances of recrystallization and burnout. Cooler operation minimizes changes in heater shape, thus reducing the possibility of heater damage and shorts.

The effects of a-c leakage and hum are reduced significantly through the dark heater. This improvement eliminates "spike" or pulse leakage currents which are sometimes present in conventional heaters.

Radio Corp. of America has started incorporating the dark heaters into its receiving tubes. The heaters will be used in a wide variety of popular tubes intended for home radios, auto radios, television sets and phonographs.

• **STAINLESS-STEEL SUPERSONIC AIRCRAFT,** under construction at Bristol Aircraft, Ltd., Bristol, England, is intended to be the world's fastest atmosphere aircraft (above 1500 mph). It is a single seat, mid-wing monoplane with twin, wing-nacelle mounted powerplants.

The aircraft is constructed largely from stainless steel. Length is 35 ft 1 inch, wingspan 71 ft and body cross-section 45 inches wide by 59½ inches deep maximum. Expected skin temperature at operating speed is 450F. Powerplants will be two deHavilland Gyro Junior DJG-10 with afterburners developing 14,000 lb static thrust with reheat. The Bristol T-188 is the latest in a series of advanced aircraft designs, each using more stainless steel than its predecessor.



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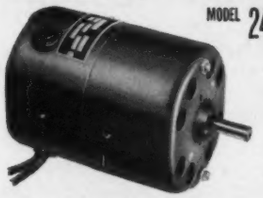

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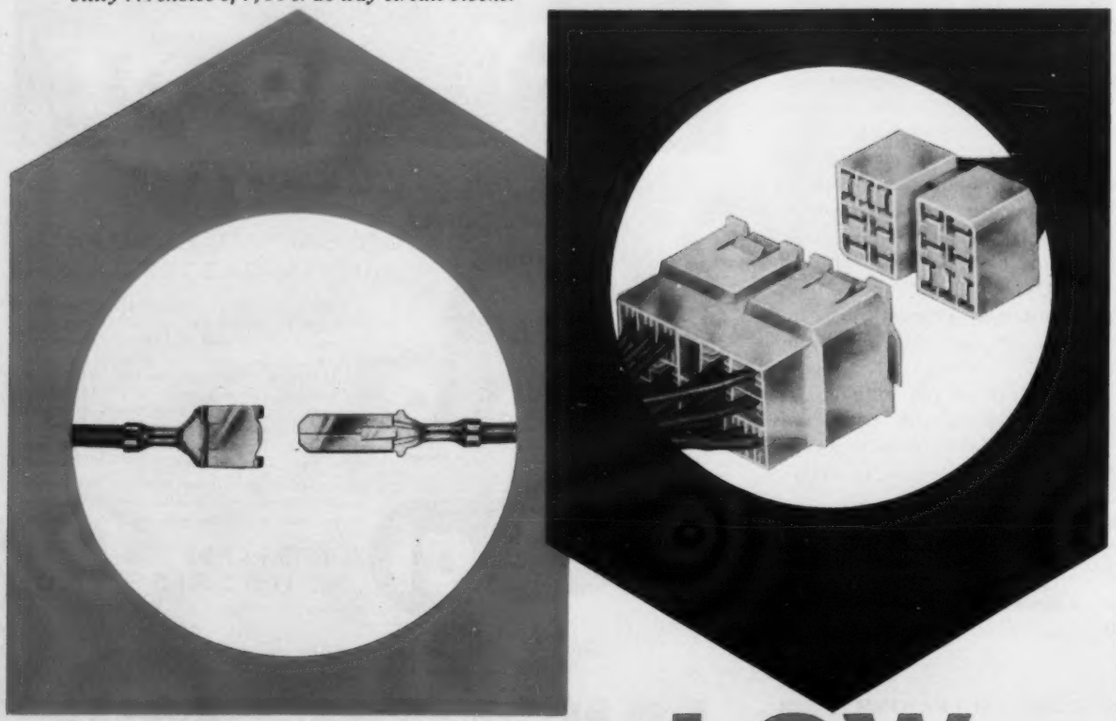

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College Station, Tex. **Apr. 17-19**	CONFERENCE for Protective Relay Engineers, Memorial Student Center.
New York, N. Y. **Apr. 17-21**	ANNUAL MEETING and Welding Exposition, American Welding Society, Hotel Commodore.
Detroit, Mich. **Apr. 18-20**	TECHNICAL CONFERENCE, Cement Industry, American Institute of Electrical Engineers, Sheraton-Cadillac Hotel.
Peoria, Ill. **Apr. 20-22**	ANNUAL MEETING AND CONVENTION, Illinois Society of Professional Engineers, Pere Marquette Hotel.
Indianola, Iowa **Apr. 21**	IOWA SECTION MEETING, Mathematical Association of America, Simpson College.
Pittsburgh, Pa. **Apr. 23-26**	METALS ENGINEERING CONFERENCE. American Society of Mechanical Engineers, Penn Sheraton Hotel.
Toronto, Ontario, Canada **Apr. 23-27**	ANNUAL MEETING, American Ceramic Society, Royal York Hotel.

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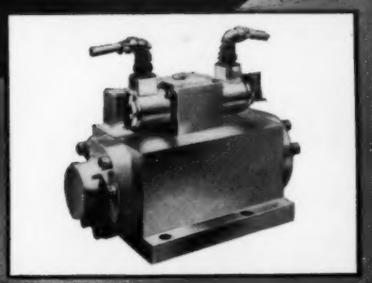

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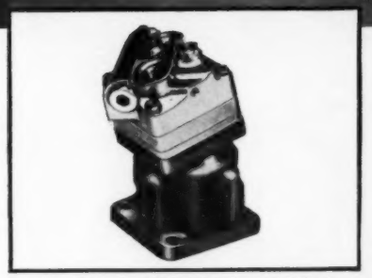

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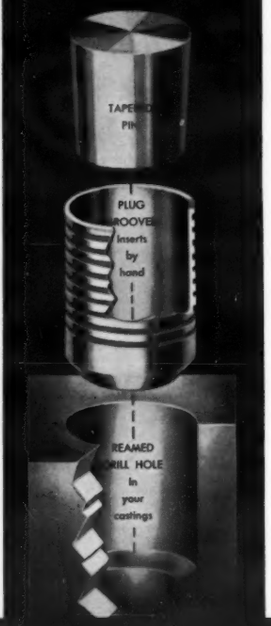

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